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Determinants of Successful Online Public Engagement Campaigns in Global Health

Ph.D. Thesis

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Abstract

Efforts in global health and development have broad political support and substantial financial commitment from most governments. However, global health organisations often have difficulty gaining the support of the public for important health interventions and policy reforms. The history of global health media campaigns has proven that it is very difficult to get the public engaged with global health issues, as compared to other forms of entertainment or public debates in the media. Strategies for capturing the attention of the general public online for persisting problems outside of emergency situations are poorly defined and there are only a few isolated examples of success.

In order to gain some insight into what factors might help to increase public engagement with global health issues I undertook a 3 year public engagement campaign using online videos and tracked detailed metrics at each step of the way.

I began the study by creating over 2 hours of global health video content across ten videos covering major topics in global health with varied style of presentation. The ten videos formed a documentary called "Survival: The Story of Global Health". These episodes were then shared through social media, promoted through Youtube and finally broadcast on national television to around 1.4 million total viewers. Key metrics were tracked at each stage of the process generating a rich set of data to analyse.

The study began by posting each episode with a brief background text on a Facebook profile with an average of 450 friends and a further 800 followers throughout the period of study. This was achieved by collaboration with global health professor Igor Rudan who volunteered to narrate the videos and post them from his Facebook profile.

Between Aug 1 and Sept 30, 2017 I studied the interaction with each Facebook post tracking all available engagement metrics. Remarkably one of these episodes was shared virally on Facebook leading to media coverage of the video and this provided the opportunity for further study. The website of a national newspaper with around 250,000 daily viewers shared three of these videos after they were posted on Facebook.

I recorded views, shares, comments and the effect on the number of YouTube views of the featured videos.

I then conducted two studies in two separate samples of viewers to determine the nature of engagement with each video as defined by 22 different parameters . The first study was based on posting videos to a YouTube channel between Aug 30 and Sept 30, 2017 and collecting analytics on the viewership. By June 30, 2019 this approach attracted 41,305 viewers. The second study was more controlled and conducted on a private YouTube channel and the videos were advertised to reach a high number of viewers. This attracted 188,154 viewers and I collected data on viewers' behaviour using YouTube Analytics.

The first study on Facebook showed that the 10 posts received between 65 and 274 "likes" on the Facebook profile and between 2 and 124 shares, receiving between 0 and 17 comments. The three episodes that were shared by the online newspaper portal were further shared between 164 and 2820 times, receiving between 8 and 111 comments from general public. The effect of these two promotion channels on YouTube viewership resulted in between 107 and 9,784 views of the 10 featured videos, with the number of "likes" received on YouTube ranging between 0 and 43. The video that raised the most attention and shares was the one on the history of pandemics, which also had the highest number of shares on YouTube (69), followed by the video on human evolution (14). Topics of non-communicable diseases and the future of humanity were also popular, while the topics more specific to global health raised less interest - i.e., maternal and child mortality, major infectious diseases, international organizations, inequality and equity, and UN's Millennium Development Goals.

The two studies on YouTube showed clear differences in all measured parameters of engagement based on the topic of the video. Episodes on pandemics (14,594 views) and human evolution (10,761 views) were clear positive outliers, while the remaining eight episodes received between 1,110 and 3,197 views. In the second study, there were several notable differences between the 10 videos in the parameters analysed through YouTube Analytics. Episode 2 on maternal and child health had the highest view rate (18.90%) and Episode 4 had the highest average view duration (6 minutes). At the

bottom of the rank were Episode 6 on ageing and dying (view rate of 13.83%) and Episode 5 on non-communicable diseases (view rate 14.59%).

Analysis of the data from the Croatian National Television, which reached >1.4 million viewers cumulatively, showed that the number of viewers tuning in at any point was the highest for Episode 5 (202.848), followed by Episode 3 (169.908) and Episode 1 (152.322), while Episode 7 (93.149) and Episode 8 (81.160) had the lowest reach. However, in terms of average viewership, Episode 5 (122.200) was followed by Episode 9 (104.604) and then Episode 1 (100.886).

Across the studies my research identified 5 main factors contributing the success of videos which performed well.

1. Contribution to public debate.
2. Timing of release within windows of opportunity for increased engagement.
3. Promotion by global health figure with authentic scientific background.
4. Positive emotional valency.
5. Entertainment value of content (Narrative formats, dramatic presentation.)

The major challenge of promoting global health health videos online is the long-term development focus of global health topics in contrast to a shortening media and public attention span. This was reflected throughout the study in the low engagement with videos on sustainable development goals or internal matters of global health policy and development (episodes 7 and 8). And in the far higher engagement with videos of story-based content with dramatic visuals and music (episodes 1, 4 and 10).

The public primarily looks to social media for entertainment and in such an environment it can be incredibly difficult to promote the complex humanitarian and scientific global health agenda against waves of short-form highly entertaining media "candy". However we did have one outlier result in Episode 4 which cut through the social media noise quite effectively.

The unique viral spread of Episode 4 resulting in national television broadcast to over one million viewers illustrated the value of what I have called "engagement windows" in this study. I define an "engagement window" as a unique combination of circumstances that open the opportunity for an unusually high level of engagement with the public. In the case of Episode 4 three main factors catalysed this engagement window:

1. The presence of a vocal anti-vaxxer movement in Croatia.
2. The outbreak of measles in the Croatian population.
3. The need for a credible scientific voice in the public debate.

The combination of these three factors led to high levels of engagement with the video, viral sharing and national broadcast among the population.

However such an opportunity was only able to be taken advantage of after extensive preparation. An enthusiastic core audience needs to built in advance of such times in order to reach a critical mass of supporters and trigger network effects and viral sharing when a window of opportunity arises. This can be achieved with consistent offering of valuable media content to supporters through social media which builds relationships and support for a project. This needs to be a consistent, regular (daily if possible) effort throughout a project in order to generate real engagement and support, not an afterthought at the end of a project.

Another important lesson I learned was that the public engage more readily with content which is positive, entertaining and fits in with their current interests. Many use media as a means of escape from the harsh realities of daily life and do not want to engage with heavy subject matter while looking for escape and entertainment. This was reflected in the very low engagement with the episode on "Ageing and Dying". Clearly many global health topics deal with serious and sometimes tragic subject matter. In such cases creative approaches to communicate inspiring stories of the action taken to solve problems and improve the lives of others in difficult circumstances may prove effective. Long-term engagement with viewers needs to be fostered through primarily positive interactions as audiences become fatigued with

traditional guilt-based or negative emotional appeals. The often light-hearted, positive and pro-active approach of Bill Gates personal blog is an excellent example of how to deal with difficult topics in a positive way.

Having a narrator with an authentic scientific background gave credibility to the message in the videos, the value of which was reflected in the comments posted in the online news portals. In other areas of popular science many of the most effective popularisers have a significant background in research and study. The global health community has a unique voice to contribute to public debate but few public facing figureheads to create a strong media identity. The values of science, equality and equity, technology and long term perspective were the key messages we instilled in each episode and led to a favourable reaction from the public.

Many of these insights are reflected to some degree in social media marketing research indicating that these are not necessarily specific to global health promotion. The global health community could benefit greatly from adopting some of the social media marketing strategies currently being used in the commercial world. An interdisciplinary approach to public engagement could successfully combine the work of highly skilled creatives with academics.

Through a combination of these strategies and more to be identified the global health community could approach its engagement with the public as an on-going mutually beneficial interaction distilling complex long term development goals into entertaining content which gradually invites the audience to a deeper understanding of global health issues.

Lay Summary

Efforts in global health and development have broad political support and substantial financial commitment from most governments. However, global health organisations often have difficulty gaining the support of the public for important health interventions and policy reforms. The history of global health media campaigns has proven that it is very difficult to get the public engaged with global health issues, as compared to other forms of entertainment or public debates in the media. Strategies for capturing the attention of the general public online for persisting problems outside of emergency situations are poorly defined and there are only a few isolated examples of success.

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Declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where stated otherwise by reference or acknowledgment, the work presented is entirely my own.

Iain Campbell August 2019

Dedication

I dedicate this PhD to my wife Rebecca Campbell for her unfailing kindness, friendship and strength of character which always reminds me there is much good in the world.

To my father and mother Harry and Jill Campbell for being the best example of selfless and caring humans that I know.

To my friend and mentor Igor Rudan for sharing his great enthusiasm for life which is a joy and privilege to be around.

Acknowledgements

I would like to express my sincere gratitude and thanks to my advisor Professor Igor Rudan who constantly supported and encouraged me throughout the PhD. It was a true honour to be mentored by someone who has achieved such great impact on the world of Global Health. I learned many incredibly valuable lessons both in academia and in general life which I will always remember and implement. It is rare to have such an opportunity to be mentored by such a figure and I especially appreciated his constant dedication of time to support me on this PhD. His great patience, immense support, knowledge and enthusiasm have made him a great friend as well as a mentor. From Professor Rudan I learned:
To build self-respect by taking responsibility for every situation and outcome in life.
That all things of real value are born of the compound interest of daily, consistent effort.
The value of punctuality and meticulous attention to detail in all aspects of life.
The importance of tackling all problems and set-backs head-on.

I would like to thank my wife Rebecca for her firm belief in me and my work as well as her constant support and kindness in every area of life. I could not have completed this PhD without her incredible support, encouragement and faith. I admire and aspire to be more like her in many ways more than she could know.

I would like to thank my father Harry for his unfailing belief in me and his uncompromising persistence in orientating me toward meaningful goals. For his example of many constant acts of selfless service toward myself and others which have challenged me to become a better person.

I would like to thank my friend Dan Lyth for being a great friend and encouragement to me throughout this PhD. I'm constantly inspired by your uniquely thoughtful, scientific and insightful approach to all aspects of life.

I would like to thank my friend Muslim Alim for his constant positive example and influence which has shown me and many others a better way of doing life just through being himself.

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Abbreviations

GHWA - Global Health Workforce Alliance

NCCPE - National Coordinating Centre for Public Engagement

STFC - Science and Technologies Facilities Council

AAAS - American Association for the Advancement of Science

WHO - World Health Organisation

GVAP - Global Vaccine Action Plan

USAID United State Agency for International Development

MOOC - Massive Open Online Course

UN - United Nations

MMR Measles, Mumps, Rubella

YT - Youtube

FB - Facebook

ONP - Online News Portal

TB - Tuberculosis

BMI - Body Mass Index

CRISPR - Clustered Regularly Interspaced Short Palindromic Repeats (DNA Sequence)

Chapter 1:
Introduction

1.1. Helping global health topics go viral online

Koplan et. al define global health as "an area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide." [1] The term "global health" came into use in the 20th century to describe inter-disciplinary collaboration on a range of trans-national health issues [2]. Developments within biomedical science, global economics and politics and their interactions with the fields of international and public health have all contributed to the emergence of a new world of global health. The relevance of global health to so many aspects of life for the global population should make global health research highly amenable to public engagement and popularization. However, it is difficult to know which strategies could succeed in attracting a large number of viewers to video materials which convey accurate global health information. The popularisation of science has become particularly important in recent years, where it has become apparent that reliable information online is often drowned out by the background noise of inaccurate yet appealing "click bait" content [3]. Humans seem to be quite receptive to alternative views, especially when they are surprising, shocking or spectacular, or when they seem to be contrary to long-held popular beliefs or common knowledge [3,4]. Such news often tends to be more interesting to the broad population than stories which convey accurate information [4]. This poses a potential danger when the creators of alternative and "fake news" attack an important public health issue and cause confusion among the population, thus risking reversal in many hard-achieved gains in population health [5]. Anti-vaccine movements are probably the most striking example of this risk [6].

Increasingly, the scientists involved in global health, but also all other areas of science, are beginning to realise that moving forward and generating more knowledge for humanity is not our only task; in fact, it may no longer be our main task, either. Communicating the knowledge that has been generated to a broad spectrum of people in a convincing and accurate way may be just as important, if not more [6, 7]. Otherwise, we are risking a new phenomenon: that those who generate new knowledge become isolated from the majority of the human population, the later no longer understanding the results of science properly, and showing a propensity for moving backwards as a consequence of reading inaccurate information found on the internet [6,7].

We need to consider novel approaches of knowledge dissemination to combat the spreading of misinformation which counters the scientific knowledge achieved through many years of hard work and rigorous experimental science underpinned by the most modern technology available to researchers [6,7]. Only through mastering our communication of scientific progress in the 21st century to the general population can we expect support for further research and the prevention of large groups of people questioning modern science and moving us backwards in time.

The majority of scientists are not trained in communicating the results of their research to large audiences of lay people in the general population. Moreover, research has shown that scientists are not even sure how public engagement fits into their job role [8,9]. There are few benchmarks or rewards for this work, it takes a lot of time while distracting them from their core work (such as raising grants and writing papers), and they even worry how such engagement work may affect their reputation among their colleagues [8,9].

In this PhD, I aim to explore effective strategies of promoting global health issues online and through other mass media in order to reach wide audiences. Since the 1990s generations have grown up using the internet as a primary source of information, communication and entertainment and have moved away from traditional television and radio where public health messages were more likely to be well scrutinized. While the internet provides incredible opportunity for public engagement it also makes many people vulnerable to misinformation of various sorts which can be conveyed in a highly convincing manner. Viral spreading of misinformation has the potential to strongly undermine a consensus in the population over important public health issues and gains, and it deserves to be recognised as a serious problem of our time,

In addition to the problem of the accuracy of the information on global health found online, the other side of this problem is how to make global health topics and issues attractive to the public, in competition with popular music, celebrity gossip, sports, movies and other forms of entertainment. This battle for attention was well illustrated in an iconic attempt to make the topic of global maternal and child mortality “sexy” by

Save the Children. The charity famously organised an audition for New York's best-looking male and female models and asked them to read out into the camera the facts about maternal and child mortality in their most seductive voice. Clearly such difficult topics will continue to require highly creative solutions to capture the public's attention [10].

Despite the challenges, there have been some wonderful success stories in conveying global health issues to wide audiences online. The hero for so many, the late Dr Hans Rosling, was arguably the most famous statistician in recent decades due to his remarkable efforts in visualising extremely complex and multi-dimensional data and presenting them in a way that was engaging and educational for the masses [11]. He proved that even the most complex and impenetrable data can be effectively communicated on a large scale. His short film "200 Countries, 200 Years, 4 Minutes - The Joy of Stats", aired by BBC 4, accumulated more than 8 million views on YouTube to date [10], while his famous TED talk "Debunking third-world myths with the best stats you've ever seen" was watched by nearly 2 million viewers [13].

Several other online efforts in promoting global health issues have reached notable viewership. The Global Health Media Project develops educational videos for frontline health workers around the world. In collaboration with the International Federation of Red Cross and Red Crescent Societies, UNICEF, and Yoni Goodman, they developed a cartoon "The Story of Ebola", which served as an educational material on this epidemic and accumulated over 29 million views [14]. Their earlier film, "The Story of Cholera", also became incredibly popular and has 12 million views [15]. Another notable success using animated stories was achieved by the Global Health Workforce Alliance (GHWA), in partnership with bliinktv in the UK, which developed a beautiful animated film called "Imagine..." on the shortage of health workers in many of the world's poorest countries and settings [16]. It has been watched over 160,000 times. Other notable efforts are a YouTube channel by the Editor-in-Chief of the journal "Globalization and Health", Dr Greg Martin, who has produced nearly 100 videos on various global health topics and attracted more than 19,000 subscribers to his channel [17]. There is now also a Global Health TV channel on YouTube with more than 140 videos posted, as well as Duke University's Global Health institute's channel, with more than 440 videos posted.

Still, these successful efforts are very rare outliers. There are less than 100 videos on YouTube today focused on “global health” which have been seen by 10,000 viewers or more. But this does not mean that the general public is not interested in global health topics. Many "vertical" issues found under search terms such as “superbugs”, “antibiotic apocalypse”, “zika”, etc., would not be found under the “global health” search term, but there are videos on these topics which are hugely popular and have attracted millions of views. This sends an important message that, if scientists are to engage with massive viewership online, they need to acquire an understanding of the language that is being used in the mainstream media to "label" global health issues, rather than stick to their scientific vocabulary.

Marketing and consumer psychology research is beginning to gain some insights into what makes online content popular. For example features of “viral” online content have been described by Jonah Berger and Katherine L. Milkman is their study “What Makes Online Content Viral?” [18]. In this PhD, I will present my own attempt to develop viral educational content on global health in the form of a Massive Open Online Video Course at the University of Edinburgh, called “Survival: The Story of Global Health” [19]. I will document my strategies and studies in order to explore how to make effective global health public engagement material with the potential to spread virally online.

1.2. Definition of public engagement in science

"Public engagement" in science is a term that covers a broad spectrum of activities undertaken by the scientific community. The precise definitions are constantly evolving to incorporate new means of engagement, facilitated by emerging technologies.

Several organisations that promote public engagement activities have provided some broad definitions.

The National Co-ordinating Centre for Public Engagement (NCCPE) defines public engagement as: "the myriad ways in which the activity and benefits of higher education and research can be shared with the public. Engagement is by definition a two-way process, involving interaction and listening, with the goal of generating mutual benefit". [20]

The Higher Education Funding Council for England further emphasises the "two-way" process of Public Engagement:

"'Public engagement involves specialists in higher education listening to, developing their understanding of, and interacting with non-specialists. The 'public' includes individuals and groups who do not currently have a formal relationship with an HEI through teaching, research or knowledge transfer." [21]

The Research Councils UK public engagement concordat defines public engagement as a diversity of activities including:

- Participating in festivals
- Working with museums / galleries / science centres and other cultural venues
- Creating opportunities for the public to inform the research questions being tackled
- Researchers and the public working together to inform policy
- Presenting to the public (e.g. public lectures or talks)
- Involving the public as researchers (e.g. web based experiments)

• Engaging with young people to inspire them about research (e.g. workshops in schools)
• Contributing to new media enabled discussion forums [22]

This definition published in 2010 could be expanded to include novel methods of Public Engagement such as Massive Open Online Courses and other e-learning methods which are rapidly increasing in popularity [23].

1.3. Importance of public engagement in science

In recent years many of the institutions that govern and fund public research have called for increased participation in public engagement [24]. This call has been supported by a number of large public engagement grants from organisations such as The Wellcome Trust and the Science and Technologies Facilities Council (STFC).

In 2008 Research Councils UK and The Wellcome Trust established the National Coordinating Centre for Public Engagement with an aim to "support a culture change in the HEI sector" [25]. The increasing importance of translation of research results towards the benefits of the wider general public, including public engagement, was recognised in the 2014 Research Excellence Framework which awards 20% of the overall score to "impact". Thereby, impact was very broadly defined as 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia'. [26] Research Councils UK now require a 2 page "Pathways to Impact" statement with all bids [27] and have published a Concordat for Engaging the Public With Research [21]. As of 2010 The European Commission has recognised public engagement as the most important factor in its "Responsible Research and Innovation" and "Science with and for Society" frameworks [28].

These developments have led to the institutionalisation of public engagement in many higher education institutes. However, many researchers are still unsure of how to participate effectively. In December 2015 a Consortium of 16 funders of UK public research commissioned a research study to investigate the current landscape of public

engagement by researchers in higher education, research institutes and clinical settings. The consortium concluded that while participation and value placed on public engagement has increased in recent years, "researchers and institutions remain uncertain about public engagement, within the context of a profession that is driven by research (and teaching)." [29]

The majority of researchers within science, technology, engineering and mathematics participate in public engagement [30]. However, despite encouragement from large funding bodies such as the Wellcome Trust to increase participation, many academics still do not regard science communication as one of the central aspects of academic life [30]. A 2006 Royal Society Survey of factors affecting science communication based on a sample of researchers in science, technology, engineering, and mathematics reported that 74% of the scientists surveyed had taken part in public engagement activities within the previous 12 months and 70% agreed that funders should encourage such activities. However 64% reported that the need to focus primarily on research prevented them from becoming more engaged [30].

With the rapid evolution of digital technologies and communication, the higher education and research sectors have been relatively slow to utilise social media [31]. This has created confusion around the place of public engagement in these areas, which have themselves undergone broad structural changes in recent years.

As a result of insufficient science communication, the public's perception of many key scientific issues varies considerably from that of the scientific community [24]. A study by The Pew Research group in association with the American Association for the Advancement of Science (AAAS) illustrated this difference of opinion with regard to biomedical science. For example, the gap between citizens and scientists opinion on whether genetically modified foods are safe to eat differs by 51% [24]. A recent article in Nature concluded: "this strategy of isolation is not effective in today's world...In the face of a rapidly changing society, science researchers must learn from Darwin and evolve." [32] Similarly the Academy of Medical Sciences April 2016 report to the House of Commons on Science Communication concludes:

"For the UK to continue to lead the world in scientific research, we must deliver communications that demonstrate science is at the heart of British culture. This requires a concerted effort on the part of scientists, the media, Government and society as a whole to promote conversations about the scientific method, its benefits and shortcomings." [33]

The Pew Research study highlighted both a desire on the part of scientists to engage with the public and dissatisfaction with current media coverage of scientific findings. 79% of the scientists surveyed believe that inaccurate media reporting is a major problem for science. [24]

While scientists increasingly view interaction with the public through the media and social media as an important means to advance their career, the majority still consider it to be a secondary activity to other academic commitments [24].

1.4 The Impact of Social Media on Science Communication

In order to contextualise the impact of social media on the world of global health its use in science communication more generally is reviewed in this section.

In each succeeding generation of academics certain figures have emerged with exceptional abilities in communicating research and scientific concepts to the general public. These exceptional communicators developed unique skills in communicating science through the popular languages and media of the time. From Johannes De Sacrobosco making Arabic mathematical numerals accessible to European audiences in the 12th century to Stephen Hawking translating the far reaches of theoretical physics into compelling visual analogies on television in the 20th century. The scientists who have succeeded in capturing the attention and imagination of the public have been those who have used their unique personalities combined with the strengths of the available media outlets at the time to deliver compelling content.

The rise of social media has now removed the traditional gatekeepers of the media and has allowed almost anyone with an internet connection to broadcast their message to

large online audiences. This comes with both benefits and risks to the scientific community. On the one hand, it has never been easier to disseminate the results of research to the public; on the other hand, misinformation has never been able to propagate through a population more quickly. As scientific information enters the domain of social media it needs to compete against other forms of entertaining content for the interest of the public. This makes it more important than ever to understand how to make scientific content appealing to engage with on social media. In this review, I will examine the use of the 3 largest social media platforms being used by the scientific community for public engagement: Facebook, Twitter and YouTube.

The NCCPE recently released a highly popular guide to engaging the public through social media [34]. It highlights the strengths and weaknesses of each of the major social media platforms: Twitter, Facebook, Snapchat, Instagram, Reddit and YouTube.

In the report, Twitter is highlighted as useful for assessing public opinion on a topic in real-time and engaging with current debate. However, it is also recognised that due to the sheer number of voices it can often be hard to make a meaningful impact on the conversation. Facebook is praised for its “groups” which can allow for large diverse audiences to form around topics of scientific interest. However, there are also barriers to significant engagement within the algorithms of Facebook that determine which posts will be the most visible to users. For this reason, paying for promotion is increasingly the most reliable method to achieve reach. Snapchat allows users to engage with topics “in the moment” however it is not ideal for two-way interaction and generating conversations which keep viewers engaged in the longer term. Instagram is an effective way to reach younger audiences but the image only format makes it hard to go beyond delivering basic scientific concepts. YouTube is clearly the leading platform for video engagement however the costs and skill needed to produce video content could be a barrier to entry for some researchers. The major strength of Reddit is the large sub-communities gathered around niche scientific interests however this can also make it confusing and alienating to those are not familiar with the culture of the website.

Each of these platforms have been used in public engagement campaigns for scientific projects however only Facebook, Twitter and YouTube as the most established platforms have any significant amount of published research. The role of each of these platforms in the broader field of science communication is examined in this chapter.

1.4.1 Twitter and Science Communication

The microblogging platform Twitter was established in 2006 and has risen to prominence in the social media landscape with a daily active user base of 126 million people as of February 2019 [34]. The short form content has encouraged "in the moment" commentary on current issues which presents both great opportunity and risk to users. Information can be disseminated to thousands or millions of users rapidly however this power has landed many scientific figures in the middle of public outcry over impulsive tweets. The benefits and risks of Twitter are perhaps best exemplified in the engineer and entrepreneur Elon Musk who has become one of the most influential communicators of science to the general public with over 33 million followers in 2020. His Twitter activity has raised awareness of sustainable energy technology and inspired many to pursue scientific careers. However, he has also become the focus of many public controversies and legal battles in response to impulsive and angry tweets he has later regretted posting [35].

Glänzel et. al note that twitter use in academia is carried out by most of the major groups within the academic community including conference organisers and attendees, Universities, libraries, journals and publishers [36]. However, while Twitter is gaining popularity among a broad spectrum of the academic community the numbers are still small relative to the potential user-base, with estimates ranging from 2% to 33% of scholars on the platform [37]. It is also unclear to what extent the scholarly community use twitter as a tool to promote their research as opposed to simply using it as a social tool. Holmberg and Thelwall examined over 500,00 tweets from 447 scholars and less than 4% were found to be communicating their work through the platform [38].

The importance of twitter in influencing public opinion on issues ranging from vaccination to presidential candidates has been apparent over the past decade however objective measures of this influence have been much harder to establish. The

contribution of twitter towards the establishment of measures of social media impact is perhaps the most interesting aspect of its use in science communication.

As early as 2008 The Journal of Internet Medical Research began tracking the spread of its articles on Twitter and this was relatively uncommon at the time. As the Twitter user-base has grown many other journals and funding bodies have sought to obtain an accurate assessment of social media impact through the platform [39]. The need to measure this impact served as a catalyst for the establishment of "altmetrics" which measure non-traditional bibliometrics in addition to traditional citation-based metrics [40].

The most comprehensive definition of altmetrics comes from Galligan:

"Altmetrics are new measurements for the impact of scholarly content, based on how far and wide it travels through the social Web (like Twitter), social bookmarking (e.g. CiteULike) and collaboration tools (such as Mendeley) … What altmetrics hope to do is provide an alternative measure of impact, distinct from the Journal Impact Factor, which has been categorically misused and is unable to respond to the digital environment that scholarship takes place in today." [41]

One of the key strengths of Altmetrics is that they can reflect impact outside of the academic community. There are many examples of papers which have had tremendous public impact and yet relatively few citations or which have had a delayed recognition in the academic community [42]. Altmetrics provide a much faster measure of research impact and are quite transparent with the scripts and algorithms used to make the assessment being open to examination and scrutiny. As researchers begin to share extra materials in addition to journal papers such as presentation slides, raw data sets and other scholarly outputs Altmetrics allows for their impact to be assessed.

Altmetrics.com has become a leader in the classification of altmetrics and measures several key metrics which form the basis for its scoring system. These include citations on Wikipedia and public policy documents, peer reviews on Faculty of 1000,

discussions on research blogs, mainstream media coverage, bookmarks on reference managers like Mendeley and mentions on social networks.

The Altmetric.com score which is now widely used is calculated by an automated algorithm with weighted scores for each mention of the paper in various types of media. In descending order of the weighting these are: News, blog, policy document, patent, Wikipedia, Twitter, Peer review, Weibo, Google +, F1000, Syllabi, LinkedIn, Facebook, Reddit, Pinterest, Q&A, YouTube, Number of Mendeley Readers, Number of Dimensions and Web of Science citations [43].

While it is very useful to have a quick indication of a papers reach beyond citations Altmetrics are a relatively new form of impact measurement and there are still several limitations which need to be addressed. A major criticism of Altmetrics is the observation that the spread of information through social media does not necessarily correlate to its scientific value. A study investigating the differential diffusion of all verified true and false news stories (126,000 total) shared on Twitter between 2006 and 2017 demonstrated that false news spread more quickly and broadly than true news in every category. The study concluded that the primary reason for this is the novelty of the false news and that people tend to share novel information more readily [44]. The majority of valuable scientific research is comprised of small constructive advancements within a field which are largely un-dramatic and are often written in scientific terminology which is impenetrable the general public. Such work is unlikely to achieve high Altmetric scores compared to controversial or highly novel presentations of information which may be of less scientific value. However, there does appear to be at least some correlation between initial tweet volume and a later rise in citations [45]. Eysenbach compared metrics of Twitter impact with traditional measures of scholarly impact from articles in the Journal of Medical Internet Research and demonstrated that tweets can predict highly cited articles within 3 days of publication [45]. Costas et. al confirm the correlation but notes that it is quite weak and that tweet volume should certainly not be considered as of similar value to traditional impact scores [46]. At this stage the best that can be said for tweet volume as a metric is that it may provide a quick indication of the potential for later citations. However, the metric does have some

inherent value in indicating interest from the public in scientific information and need not be considered only in relation to its predictive value.

A further limitation of Altmetrics is that the are several ways in which the system can be exploited which would not be possible through traditional citations. Journals with large social media followings who routinely tweet their papers will generate higher Altmetric scores which are not necessarily reflective of the quality of the content. For this reason Eysenbach who established the "Twimpact" factor [47] recommends combining the Altmetric score with traditional impact scores to give a more rounded picture of the true impact. Altmetric scores also count any reference whether positive or negative towards the overall score. While citations generally indicate some usefulness of the research; blog posts are often written to criticize work and even these mentions would contribute to an overall positive score. For example a recently debunked 2010 paper reporting changes in marine animal behaviour due to ocean acidification has an Almetric score of 121 putting it in the top 5% of all research outputs scored by Altmetrics. However a closer look at the profile of this paper on Altmetrics [48] reveals that 2 of the 9 news stories (the most heavily weighted category for the score) report on the de-bunking of the study. Sentiment analysis of online text is becoming more common in social media analysis and could be used to distinguish between social media mentions in favour and not-in-favour of the research output to provide a more objective measure of impact [49].

The current evidence indicates that Altmetrics are an evolving tool with many clear benefits for evaluating the impact of research outputs outside of traditional measures. The ultimate usefulness of Altmetrics will be determined by how quickly and comprehensively their current limitations can be addressed. Future developments should include efforts to control for self-promotion through large social media accounts and should consider applying filtering of negative social media posts from the scoring using sentiment analysis.

1.4.2 YouTube and Science Communication

Although a scientific understanding of science communication on YouTube is still in its infancy there are some early studies which have laid some useful groundwork for further research.

Welbourne et al. examined factors which affect channel and video popularity in science communication on YouTube tracking the following engagement metrics for 390 videos:

"(a) Video view count;
(b) Number of comments on the video;
(c) Number of subscriptions driven from the video;
(d) Number of times the video was shared;
(e) Total number of ratings."

These were then compared to the following features of video content: Type of channel (professional or user generated), video length (seconds), pace of content delivery (words per minute), communicator continuity (one communicator or multiple), Gender and video style (Vlog, Hosted, Interview, Presentation, Voice over visuals, Text over visuals).
[50]

The first analysis of these engagement metrics revealed that all of the metric scores were strongly correlated to one another. It was therefore decided that only video views were required as the dependent variable in the final analysis alongside the video features. 3 factors significantly contributing to the popularity of the video were revealed: user generated content, a regular communicator delivering the content and fast delivery of the content. They suggested that the first 2 factors help to foster more meaningful connection with the viewers allowing the presenter to build a relationship and trust with the viewer as a communicator of accurate information over the course of several videos.

While this study provided some useful insights into the presentation of science videos on YouTube there are several methodological issues which prevented deeper insights being extracted from the data. Collapsing all engagement metrics to be represented only by video views significantly restricted valuable insights into the nature of engagement. Views represent only the minimum engagement from the audience and do not give much insight into the nature and extent of the engagement. By this method of measurement, a view lasting 6 seconds has equal value to a view lasting the duration of the video. Valuable information on engagement quality is thereby lost without the additional data being considered. To remedy this the views metric could have been supplemented with average view duration or video "retention rate" which tracks what percentage of viewers kept watching the video until pre-defined set points. A strong case can be made that higher average view durations reflect true engagement more accurately than high numbers of views. Often videos with attention grabbing titles or thumbnails can gain large viewership but very low retention due to low quality content. Conversely videos on niche science topics can generate a relatively small number of views and yet the high retention and number of comments generated by heated discussion indicate a high level of engagement. Considering the importance that the NCCPE place on the two-way nature of public engagement one could argue that comments on the video are one of the most important factors indicating engagement as they constitute the first step in a two-way interaction between the public and the science communicator. [51]

Another study highlighting this need for measurement beyond basic metrics analysed immunization videos on YouTube. View count and viewer rating (1-5 stars) were collected for 153 videos and categorized as "positive" if pro-vaccination, "negative" if against vaccination or "ambiguous" if the motivation was uncertain. 48% of the videos were categorized as positive, 32% as negative and 20% as ambiguous. It is interesting to note that negative videos received both higher views and higher ratings while pro-vaccination public service announcements attracted the least engagement from all of the videos categorized as positive. This study highlighted the existence of a significant anti-vaxxer presence on YouTube as early as 2007. It is unfortunate that YouTube demographic data was not also collected as this could have provided valuable insights into this movement. For example, it could have been determined which countries had

the highest concentration of anti-vaxxers and to what age group they belong. Such data, if available, would have proven useful for academics seeking to extract further insight from the study. [52]

The usefulness of such additional demographic data was demonstrated in a study which tracked engagement with student-made Chemistry videos on YouTube [53]. The study tracked the numbers of views, subscribers and average watch-time and categorised this data by the home country of the viewer. The demographic data revealed far lower view times in countries where English was not the first language. Simply subtitling the videos in the native language of these country resulted in significantly higher views and watch times than in territories where this was not performed. These obvious but not always apparent insights are often over-looked when metrics are restricted to view-counts and likes [54].

As YouTube has grown in popularity researchers have slowly developed more sophisticated approaches to tracking and analysing metrics on the platform. However the quality of conclusions which have been drawn from these studies has been variable. In 2015 a study on 6 anti-smoking campaign videos measured views and likes alongside demographics of viewers as well as sentiment analysis of comments in order to examine both quantitative and qualitative aspects of the metrics [55]. It claims to be one of the first studies "that empirically applied social media assessment metrics in their full measures and examined both quantitative and qualitative aspects of the three metrics in the context of a less-studied social media platform, YouTube" [55]. However very few significant insights were extracted from the data due to the small sample size and conflicting factors. For example, it was noted that one of the most popular videos was significantly promoted outside of YouTube making it difficult to determine how much the video content or its external promotion contributed to its popularity. Additionally, the study did not attempt to determine key features of the videos and link them to engagement metrics due to the small sample size which limited the depth of the conclusions which could be drawn.

Sentiment analysis of the comments was only able to indicate the general positive nature of the comments on the videos. Similar studies have sought to perform

sentiment analysis of YouTube science video comments, however again, the conclusions which could be drawn were very limited. Shapiro et.al analysed comments on YouTube videos regarding climate change noting the frequency of keywords in order to understand how the issue is framed and discussed on YouTube. They discovered a high incidence of political and scientific terms in the comments which indicated the increasingly politicised nature of the public debate around climate change. The study also revealed that the comments were largely unrelated to the video content showing that YouTube users often hijacked the YouTube comments section on popular climate change videos to promote their agenda on climate science even if unrelated to the video content. Madden [56] notes that comments from the more vocal YouTube users are not necessarily representative of the viewers as a whole and therefore it is quite difficult to draw any significant conclusions from them. Sentiment analysis has some value for gauging public reaction to a video but it is difficult to say how well it really reflects engagement with the video. Less subjective measures such as the word/character count of comments per 100 views could indicate more accurately the level of engagement from viewers and would be easier to compare across different videos.

The most comprehensive and methodologically sound approach to tracking engagement through YouTube metrics comes from a report for the Royal Institution (RI) which gathered and analyzed metrics of engagement for their online video content across YouTube and the RI's website [57]. 6.7 million of the total 7 million views across their videos were obtained through YouTube which make this study a very useful insight into YouTube engagement in science. The report differentiates between "viewer consumption" and "viewer engagement" a distinction which many of the previously discussed studies have neglected. The primary units of "video consumption" measurement were the total number of views, average views per day and minutes watched. Categorising these as viewer consumption metrics recognizes the limitations of such data and indicates only exposure to the content and not necessarily deeper engagement with it. However, the "minutes watched" metric could arguably have been taken as a measure of engagement as it reflects a level of sustained interest in the video content.

The report defines "viewer engagement" as responses to the video which inspire

conversation (in comments, forums and news articles), result in expressions of satisfaction with the content (clicking the like button) and which result in sharing of the video. These are quite helpful definitions as they indicate that the viewer has taken one step beyond simple exposure to the content. "Viewer engagement" metrics were measured as: total comments, total likes, total favourites, total dislikes, total shares and subscribers added. A further distinction is made between quantity of engagement and quality of engagement where quantity is measured as the total measured response to the video (e.g. the total number of comments) and quality would be measured in the same example as the proportion of views that result in a comment. Comments, likes, shares and subscribers were therefore also recorded per 1000 views for each video.

Features of each video were also subjectively determined by the researchers although the method for this is not detailed. Videos were categorised by subject (which branch of science they cover), theme (the main topic they cover) and format (how the information is presented).

The final analysis indicated that there was significant variation in consumption and engagement metrics by subject. It noted that Physics and Chemistry videos had higher viewer engagement than Biology videos. However, it also notes that this was driven by the high number of views rather than by the quality of engagement as reflected in other metrics such as comments and shares. Such distinctions are important as they can help to distinguish between superficial and deeper engagement with topics. Although whether this can be compared and measured in any meaningful way has yet to be studied in science communication. In fields such as marketing a final outcome such as income generated in dollars can be compared to these consumption and engagement metrics and a more objective analysis can be made of what constitutes true engagement toward the outcome. In science and global health communication the desired outcomes tend to be more subjective or hard to measure such as a change in public opinion on a key health topic or a change in health behaviour in a large general population. One of the most important developments in public engagement metrics will be to define specific measurable outcomes. This would give context to the various metrics being tracked and would allow for optimization towards the pre-determined outcomes.

The analysis of video format indicated that events, talks and animations generated the highest levels of consumption and engagement. Although it noted that the engagement generated through animations was primarily of the lower level "liking" and not commenting which may indicate a higher volume of engagement with less depth. The analysis of video duration provided an important insight into the nature of engagement. Social media content creators are often advised to keep content short due to the shortening attention span of media consumers [58]. This advice is based on higher view counts for shorter content, however a major weakness in this approach is highlighted in this study. The report noted that longer videos (50-70 minutes) were responsible for recruiting over a third of the subscribers to the YouTube channel. Subscribing to a channel is arguably the highest level of engagement available on YouTube as it indicates an intention of the user to be notified of and view further content from the channel. The recent rise in popularity of long-form podcasts on niche topics - often over an hour in length- also reflect this recent trend of high engagement with long-form content [59]. This is an encouraging indicator for global health public engagement where many of the issues are complex and can only be thoroughly explored through long-form content. It also indicates that engagement should not be determined solely through simple metrics such as view-counts as they may indicate only a superficial engagement with the content.

The combination of these metrics with demographic data provided some additional insights into audience engagement revealing that younger audiences tended to engage with Biology and Chemistry videos while older audiences preferred Maths, Space, Physics and Engineering videos. It is difficult to say how generalizable such demographic data is out-with this study but knowing the target age-group of a video could certainly be useful for refining the production style and presentation of future video content.

The report recognized many confounding factors which make it very difficult to distinguish between correlation and causation when attempting to link video features to consumption and engagement metrics. Such factors include: video marketing outside of the study affecting view counts, increased traffic due to news reporting on the topic and embedding in popular blogs. The authors suggest that econometric methods may

prove useful for teasing out the video features contributing to higher engagement however these would require very large data-sets beyond what the RI could provide.

These studies demonstrate several features of YouTube which make it an ideal platform for engagement with global health topics. It is a platform where people are willing to engage with long-form content around scientific issues and it is also possible to clearly explain complex issues with the aid of visual imagery. Useful metrics such as view duration give a clear insight into deeper engagement with the material and this can then inform effective creation of further content. YouTube has very little research in relation to global health despite a growing amount of global health video content and so it provides an ideal ground for study for this PhD.

1.4.3 Facebook and Science Communication

As the NCCPE notes one of the most powerful features of Facebook as a platform are the "groups" or "pages" which allow the organization of large numbers of people from diverse backgrounds to organize around topics or ideas. This has allowed for massive dissemination of scientific knowledge through popular science figures such as Neil DeGrasse Tyson who has over 4 million followers of his page. But it has also allowed for the rampant spread of misinformation around the safety of vaccination by the organization of the anti-vaxxer movement in Facebook groups.

One of the most insightful and comprehensive studies on the use of Facebook in science communication was carried out by The Pew Research Centre in 2018 [60]. They systematically analysed 6 months of posts from 30 of the most followed science pages on Facebook in order to find out what kinds of Facebook content generated the most interest.

The two pages with the largest following were from established science media outlets: National Geographic and Discovery. These well-established platforms have been able to transfer a level of popularity and audience obtained in the mass media through to social platforms. However, the third most popular page with 25.6 million followers was "IFLScience", which was established by a single independent biology student Elsie

Andrew. Andrew began creating this website as a side-project while at University and quickly gained thousands and then millions of followers. IFL Science combines scientific news with an irreverent communication style which has made scientific topics interesting to engage with for many who find scientific language dry or inaccessible. Andrew has stated that the page's intention is to highlight "the lighter side of science"[61].

The influence and reach of the platform was attested to by Andrew's inclusion in Time magazine's "30 Most Influential People on the Internet" in 2016 [61]. The open and egalitarian nature of Facebook allows for success stories such as these to occur quickly and organically. Bypassing the traditional gatekeeping of the mass media in this way can avoid media biases but it can also bypass important fact-checking which has been required -to some extent- by mass media outlets. The danger of this is that individuals can gain a major platform to speak on topics outside of their field of expertise with no mediating parties involved. Indeed, in recent years Andrew has come under criticism for oversimplifying complex scientific issues and even of spreading misinformation. Perhaps most famously her heavily de-bunked warning of an upcoming ice-age [62, 63].

Such incidents highlight a major concern of science communication on social media. Content creators who are monitoring their audience's engagement with their content will be inclined to create more content around topics which generate high levels of interest. Often such topics which are shocking or emotionally engaging do not present the most accurate of helpful information. The importance of emotion in the transmission of ideas is well established in the field of marketing [64] and it has been demonstrated that stories which are emotionally engaging are much more likely to spread virally on social networks [65]. Clearly the emotionality of a scientific story is in no way correlated to its accuracy or usefulness and so caution needs to be exercised in promoting such content. In response to claims of Andrew spreading misinformation she replied "I'm not trying to teach people about science. I'm trying to give people that moment where they say, O.K., this is interesting, and I WANT to learn more." [66] Regardless, users of social media are quite likely to perceive popular pages to be presenting authoritative information due to their large followings. This would seem to be inevitable even with sincere rebuttals from the content makers. Nevertheless it is

clear that Andrew is committed to improving her platform and to promoting accurate scientific information demonstrated by her recent collaboration with The Science Channel. The new television show is aimed at sifting through popular science content online to promote good information and filter out the inaccurate. She comments “let's face it, as the amount of information increases, so does the signal to noise ratio.” [67]

It is interesting to note that despite the vast range of topics covered by IFLScience Andrew mentions that the two most popular topics in her estimation were HIV and Cancer related posts [68]. Many global health projects address these kinds of emotionally engaging topics related to the health of family members or vulnerable populations and can therefore be quite appealing to online audiences. They hold a human element which can naturally make them more appealing to engage with than dry scientific information.

The posts in the NCCPE study from the top 30 Facebook pages were categorized into several broad categories referred to as “frames”:

“New Discoveries”, “News you can use”, “Promotions/Ads”, “Explanations of Concepts”, “Other Frames”, “Archived Reposts” and “Not Related to Science”

The three most popular “frames” were: New Discoveries, News You Can Use and Promotions. New discovery posts report on recent discoveries in a scientific field. News you can use report on practical scientific tips which can help the audience such as tips of healthy eating based on scientific evidence. The promotional posts were used to promote book launches, talks, television appearances and various other promotional activities.

Higher engagement was noted for posts which focused on visuals with little additional information, especially for videos. Posts including explicit calls to action such as asking people to donate to science funds were also highly popular although very rare. Finally, 26 of the top 30 pages focused narrowly on one area of science indicating that this may be a key factor for successful engagement.

Facebook is perhaps the most accessible platform for researchers who want to engage with the public. However, as this review has highlighted, this also makes it particularly susceptible to becoming a home for groups organised around misinformation. If Facebook is to be used to its full extent by the global health community then successful science interest pages such as those mentioned in this review should provide useful insights into how to form highly engaged followings.

1.4.4 Conclusions

While there are clear benefits to the measurement of engagement metrics for science public engagement there are also some clear dangers in how this information is used to inform strategy. Perhaps the most critical of these is the danger of optimizing message content based on popular demand. Often the topics and messages which generate the highest levels of engagement are not the most useful to the public. If public engagement were to become a game of optimizing metrics then it risks watering down important global health messages to make them more appealing for general consumption. For this reason, it will be important for global health researchers to treat metrics as a helpful tool but not as a guiding principle in designing media for public engagement. There are indications in this review that substantial longer-form scientific content can generate deeper levels of engagement which are not necessarily reflected in the simple metrics such as view count [57]. Global health content makers should look for these indications of deeper engagement through comments, shares and new subscribers where data is available. These insights may be particularly useful for charities and NGOs where the majority of funding often stems from a small but very highly engaged minority of their supporters. In such cases optimising only for view-counts and not the deeper engagement metrics could in fact be detrimental to their fundraising campaigns.

Allowing data to inform stylistic aspects of video creation appears to be an area of low risk and high reward for public engagement campaigns. Highly graphic orientated presentations appear to be a popular format generating high engagement with complex scientific issues. A YouTube search for “global health” returns several highly popular global health animations with millions of views and this may indicate some transferability of this finding. Global health message presentation style would seem to

be the most responsible use of metric-driven optimisation until more research becomes available.

1.5. Importance of public engagement in global health

Cohen et. al [69] lists several key benefits that public engagement can provide to the field of global health. These include creating an informed citizenry, generating new ideas from the public, increasing the chances of research adoption, increasing public trust, answering ethical research questions, fostering global communication, enabling shared experiences and methodology, standardization of strategy and generating global viewpoints.

Increasing sensitivity to global health topics among high-income countries holds the promise of increasing focus on many neglected diseases and themes, and even raising funding towards global health interventions through crowd-funding campaigns.

Until the 1990s public engagement in global health was primarily carried out through in-person events and the mass media (radio and television). As technology quickly evolves many of these campaigns are moving to online platforms. There are many lessons to be learned from mass media campaigns in global health, which may be applicable to newer online campaigns. This review will examine 3 important areas where Mass Media campaigns have been implemented in global health interventions: Tobacco Use, Vaccination Adoption, and Maternal and Child Health.

1.5.1 Tobacco Use and Public Engagement

From the 1970s to the mid 1990s many mass media campaigns were carried out to educate the public about the risks of tobacco use. A report by the National Cancer Institute in 2008 attributes a significant contribution of media campaigns to the reduction of per capita cigarette consumption by approximately one half since the peak in the 1960s [70]. A systematic review by Wakefield et. al supports this assertion [71]. However they also identify the lack of formal control groups as an important limitation of evaluating mass media interventions [72]. This limitation makes it difficult to isolate

which campaigns produced an effect. However, the overall benefit is clearly demonstrated when such campaigns are discontinued and the beneficial effects are seen to decrease [73]. Clearly, online campaigns with detailed analytics will be able to overcome many of the limitations of mass media studies.

While a strong benefit of engagement with the public through mass media has been observed, less is understood about what kinds of messages are most effective. Message content is highly important in such interventions as demonstrated by the "anti-smoking" campaigns of Phillip Morris, which actually increased the likelihood of young people smoking in the future [74]. The role of grounding in social science when designing message content has been strongly emphasised by social scientists [75]. The leading role of media campaigns in the fight against tobacco use led the WHO to conclude that "Tobacco addiction is a communicated disease - communicated through advertising, sports, marketing and sponsorship [76]." Clearly, message design should be taken as seriously in global health campaigns as it is in commercial marketing. Tobacco company counter campaigns have repeatedly used their expertise in this area to their advantage throughout the 1980s [74].

1.5.2 Maternal and Child Health and Public Engagement

Many traditional mass media campaigns have been employed in an effort to improve maternal and child health, but the results have been mixed.

A 2014 systematic review of mass media campaigns and child survival reported evidence of behaviour change in 26 of the 32 studies [77]. The campaigns promoted a wide diversity of behaviours, including antenatal care, vaccine uptake and use of oral rehydration sachets. Naugule et al. report that media intervention alone is not enough to secure behavioural change, but that as a supplement to community based initiatives they increase the uptake significantly [78].

In one of the most rigorously designed mass media interventions using radio in Burkina Faso over 20 months, limited evidence for significant behaviour change was observed despite the heavy broadcasting of the health messages [79]. It is suggested in the study

that this may be due to strongly entrenched community beliefs and practices, which are hard to shift through media exposure alone.

1.5.3 Vaccination and Public Engagement

Media coverage of influenza vaccinations is associated with increased vaccination rates and earlier adoption by the public [80]. The importance of scientists engaging with the public on such issues has been emphasized by a qualitative investigation of vaccine risk perception which reports that "parents lack trust in government agencies and may have doubts in the medical profession as the 'managers' of vaccine risk." [81].

Each year the World Health Organisation (WHO) promotes a "World Vaccination Week" as a core part of its Global Vaccine Action Plan (GVAP) [82]. Videos, graphics and other social media content are distributed during the week to raise awareness. The GVAP is currently not on track to achieve its ambitious goals. However, the SAGE 2015 assessment reports "A WHO review of the countries that have successfully eliminated maternal and neonatal tetanus put a high value on early and active community engagement [83, 84, 85]."

As early as 1987 Heggenhougen et al. asserted that the social science surrounding vaccine adoption "has been a closed book to immunization program managers for too long" [86]. More recently, prominent media experts have emphasized the importance of message content in achieving vaccination adoption in the public [87]. In recognition, the WHO has published detailed guidelines on message content for media promotion of vaccination [88]. Despite recognition in the Global Vaccine Action Plan that "Communications and social research to identify the barriers to and drivers of vaccination should inform the development of context-specific messages" there is no evidence of such research underpinning the WHO guidelines.

The influence of the media on vaccine adoption in the public is demonstrably profound. Despite increasing access to vaccination, the GVAP has thus far struggled to translate this power into the levels of adoption necessary to meet their goals. If lessons are to be

learned from the success of Tobacco interventions then interaction with social science and consideration of message design will continue to be important factors for success.

From the largely positive results of mass media anti-smoking campaigns and the measurable success of commercial advertising campaigns in the western world, it is apparent that such campaigns can be effective in changing the opinions and behaviours of a population [89, 90, 91]. However, trials of such strategies in other areas of global health have found mixed results [79]. Perhaps the key difference is the role and reach of the media in high-income vs. low and middle income countries. The majority of anti-tobacco campaigns were carried out in western countries [89], whereas vaccination and maternal and child health campaigns are primarily carried out in low and middle income countries where the media tend to hold less influence [92].

1.6 Social Media and Vaccination

Social networks exert considerable influence on the beliefs and behaviours of their members [93]. An area of global health where this effect can be observed directly is in attitudes of the public toward vaccination. Nyan et. al have demonstrated that offline health discussion networks directly affect the perception of vaccine safety and intention to vaccinate [94]. Analysis of the effect of offline social networks on parent's decision to vaccinate children has shown that the percentage of people in the parent's network who are anti-vaccination was a greater predictor of their decision to vaccinate than an analysis of the parent's individual personalities [95].

These social transmission effects are now being observed in online communities [96]. The spread of misinformation around vaccination has been fuelled significantly by anti-vaxxer social media activity where messages can spread rapidly and social groups form around these viewpoints. A report from the Royal Society revealed that around half of all mothers with young children had been exposed to anti-vaxxer media content through social media [97]. The WHO has attributed such factors as contributing to declining vaccination rates and listed vaccine hesitation as one of the top 10 global threats of 2019 [98]. The Wellcome Trust's Global Health Monitor for 2018 highlights

the growing mistrust in vaccination among the public as the cause of the recent drop in vaccination rates [99].

In the age of mass media television and radio fact-checking largely prevented such viral spread of misinformation. However, the rise of social media has removed the traditional gatekeepers and anyone with an internet connection can now broadcast their views on issues of public and global health to large online audiences. This makes it more important than ever for global health experts to understand the new media terrain and proactively deliver compelling content while combatting misinformation.

There appear to be 3 major challenges to overcome in the use of social media to promote vaccination:

1. Combatting anti-vaxxer misinformation campaigns and limiting their spread online through partnerships with social media companies.
2. Achieving social media reach for pro-vaccination messages.
3. Utilizing effective message design to combat strongly entrenched beliefs perpetuated by confirmation bias and the "continued influence effect" which will be discussed later in this review.

The WHO has recognized the spread of anti-vaxxer misinformation through social media as a major contributor to the resurgence of measles in recent years. Commenting on the measles outbreak in Samoa where vaccination rates had dropped to 31% Kate O'Brien, Director of Immunization at WHO stated "Misinformation that is spread through social media channels is really affecting the decisions of parents around whether they are going to vaccinate their children and the impact is that children are developing measles and some of them are dying." [100]. This effect has also been observed in an analysis of social media activity around the time of the release of the novel influenza AH1N1 vaccine in 2009 which revealed that clusters of negative sentiment toward vaccination on social media corresponded closely to CDC vaccination rates estimated by phone survey [101]. It is impossible to estimate the extent of the damage of such misinformation to hard-earned global and public health gains and yet

there is little attention given to understanding how such social media messages can be combatted.

In 2020 the spread of Coronavirus has created what the WHO refers to as an "infodemic" with overwhelming amounts of information both accurate and false- being shared online. This led Dr. Mike Ryan who leads WHO's health emergencies program to presciently declare that "we need a vaccine against misinformation" [102].

British newspaper The Guardian reported in 2019 that both YouTube and Facebook search algorithms actively steered people looking for information on vaccination to anti-vaxxer content through the auto-fill feature in the search bars [103]. In recognition of this British Prime Minister Boris Johnson has called for social media companies to increase efforts to tackle anti-vaxxer messaging [104]. Facebook have now partnered with WHO and will show links to WHO information on vaccines when anti-vaxxer search terms are used on the social network [104]. This solution has been implemented for those searching for information on Coronavirus but whether this will make an impact on public attitudes remains to be seen. Ultimately the same factors which make Facebook effective in facilitating increased online social connection have also resulted in the clustered organization of large numbers of anti-vaxxers forming echo chambers for misinformation [94].

Efforts to achieve similar viral spread of pro-vaccination messages online have achieved mixed results, however there are some promising early examples of success. UNICEF's "Vaccines Work" social media campaign was launched in April 2019 in an attempt to influence public opinion and increase rates of vaccination. Robin Nandy UNICEF's chief of immunization commented that "Vaccines are safe, and they save lives. This campaign is an opportunity to show the world that social media can be a powerful force for change and provide parents with trustworthy information on vaccines." [105] The campaign received significant financial support and promotion from the Bill and Melinda Gates Foundation, GAVI and the WHO and was focused around a 60 second animated film called "Protect your child from danger" which was posted on the UNICEF YouTube channel [106]. The campaign achieved over one million likes, shares and

comments under the hashtag #VaccinesWork and generated significant public debate on Twitter.

The effectiveness of such social media campaigns was partially validated under experimental conditions in a randomized controlled trial where pregnant women were presented with both normal pregnancy advice or with vaccine information on social media. Vaccine acceptance among parents was improved and the study highlighted the importance of the timing of the messaging. The period of pregnancy appears to be a window within which it is possible to disproportionately influence opinion on the vaccination of children [107].

Attempts to promote vaccination using social-media clearly require a sophisticated approach and message design is highly important as demonstrated in a study by Nyhan et. al where a pro-vaccination social-media campaign actually reduced intent to vaccinate among those who had high levels of concern about side effects [108]. Another important study by Nyhan et. al [109] provides some insight into potential underlying mechanisms at work in this effect. They discovered that a dramatic narrative about an infant in danger from not being vaccinated actually increased self-reported beliefs about serious vaccine side effects from the public. They suggest this result may be due to a "danger-priming" effect where the emotional impact of seeing an infant in danger in the context of vaccination video may create a stronger lasting emotional association than the logical message that this situation can be avoided through vaccination [109]. Nyan et. al also observed that even though refuting myths about vaccination causing autism did help to combat this misperception their corrective information campaign still led to lower rates of vaccination in those who are most concerned about this. They suggest that this was due to a form of confirmation bias where those who are committed to a belief system will become further entrenched in that belief when presented with conflicting information [109].

Lewandowsky et. al also refer to this as the "continued influence effect" where people become more deeply entrenched in their beliefs in the face of conflicting information. It is believed that several cognitive processes play a role in this effect. People appear to be more likely to accept new information when it fits their existing worldview and

cognitive frameworks [110]. Rejecting conflicting information generates less cognitive inconsistencies and saves the effort of trying to synthesize the new information with existing beliefs. Other influencing factors include whether the information is from a credible source, whether others are perceived believe it and how often the message is heard. Additionally, Lewandowsky et al. refer to the effect of reactance where people dislike being told what to think and actively resist new information if they perceive it to be delivered with inadequate justification [110]. Future campaigns could use these insights to pre-emptively overcome such psychological barriers and bridge gaps in coherence presented by new information. Perhaps the key insight afforded by this research is that these are the same psychological barriers people encounter when questioning deeply entrenched indoctrination or dogma of any kind whether it be religious, political or scientific. Evidence that people will explain away overwhelming evidence for the harmful effects of smoking is just one indicator of how deeply threatening new conflicting information can be to the identity and worldview of an individual [111]. If we are to ask such individuals to exert cognitive effort to dislodge the supporting beams of their own worldview we need to present a strong and compelling new cognitive framework to step into. Indeed, pre-exposure to misinformation warnings, repeated retractions of misinformation and corrections which fill coherence gaps introduced by the retraction are highlighted as important factors for message acceptance [111].

The opposing force in this battle is the perpetuation and exploitation of existing belief systems, a method which is clearly at work in the anti-vaxxer movement. An analysis of social media activity during the Zika crisis revealed that appeals to existing beliefs in conspiracy theories played a central role in the spread of anti-vaxxer messaging [112]. A study by Lewandowsky et. al demonstrated that free market worldview is a strong predictor of the rejection of scientific information where such information has regulatory implications as in climate science [113]. However, conspiracist ideation was a far better predictor of rejection of scientific information on vaccination. They note that conspiratorial thinking has several common characteristics such as a focus on anecdotal information, tendency to believe in multiple conspiracy theories on different topics, rejection of statistical evidence, and re-interpretation of any evidence against the theory. They note that simply presenting scientific information is often an ineffective

strategy as the conspiracy theorists perceive it as threatening and only retreat further into their belief system. Sherman proposes that counter-intuitive methods based on self-affirmation theory such as affirming the character and competence of conspiracy theorists before presenting new information are more likely to produce results. He argues that giving affirmation before new information is more likely to allow them to feel that the new information is non-threatening and can be engaged with constructively [114].

Clearly social media is a double-edged sword for the global health community in the vaccination debate. It has removed the gatekeepers of traditional media and through the loss of rigorous fact-checking it has contributed significantly to the rise of the anti-vaxxer movement. However, the willingness of social media companies to cooperate with the WHO and other global health agencies is a promising sign that this situation can be turned around. Social media is here to stay and it will be essential for the global health community to become adept at social media message design and dissemination if they are to counter the vast amount of emotionally charged misinformation circulating online. Studies such as those by Nyhan [108, 109] indicate that complex psychological factors underlie commitment to anti-vaxxer views and that these are not easily influenced simply by presenting accurate scientific information. It may be the case that collaboration between global health researchers and creatives who understand the emotional influence of social-media will prove to be the most effective approaches. This has already been indicated by the success of UNICEF's "#VaccinesWork" social media video campaign which effectively paired global health science with creative social media content [106]. However, there are yet very few examples of this level of success in global health outside of support from major funding sources and large organizations while grass-roots anti-vaxxer campaigns continue to thrive.

The outbreak of Coronavirus in 2020 should provide not only an impetus to strengthen public health infrastructure but also to increase the global health community's understanding of social media message design and promotion. While vaccine development is underway there is also a great need to develop a level of public immunity from the more dangerous strains of misinformation in the ongoing infodemic.

1.7 The Social Sciences and Global Health Message Content

As early as 1995 Altman [115] noted that the majority of health promotion research has been carried out in a social vacuum. He stressed the need to integrate contextual insights from social epidemiology into health messaging. The application of social and behavioural sciences to global health communications can allow for wider socio-political and cultural issues as well as population characteristics to influence message content.

Some significant progress in this area has been made through the application of social psychological behaviour change models to tackle vaccine hesitancy. The Health Belief Model (HBM), The Theory of Reasoned Action and The Transtheoretical Model have all been used to contextualise and understand decision making around health behaviours [116]. The common thread running through the application of these theories is the effort to gain insight into individual and community decision making as well as risk assessment related to vaccination.

The HBM has been widely implemented in health promotion and disease prevention programmes and focuses on factors which influence adoption of health behaviours including: perceived susceptibility to illness of disease, perceived severity, potential positive benefits of action, perceived barriers to action, cues to action and confidence in the ability to succeed in the intervention [117]. Assessment of individuals according to this model has been shown to have some predictive value in relation to their resistance to pro-vaccination media and vaccination itself [119]. However meta-analyses have given inconsistent results regarding which variables of the HBM are most predictive of behaviour [119]. The need to understand the underlying factors which affect individual decision making around health behaviours has only become more apparent with declining vaccination rates in mulitple countries which the WHO has partly attributed to the spread of misinformation through social media [120].

The WHO Strategic Communication Framework for Effective Communications acknowledges the important role of social science in global health communication mentioning that “There are many research-based social science models and theories

that describe effective communications approaches leading to health protection action." Their framework distils the WHO understanding of effective messaging into six principles: accessible, actionable, credible and trusted, relevant, timely and understandable [126]. These insights into message framing have emerged in-part through lessons learned in major crises such as pandemic outbreaks.

The H1N1 pandemic in 2009 generated a surge of social science literature during and after the pandemic as summarised by Bararelet et.al [122]. They note several key themes in the social science commentary on the pandemic, several of which are related to the media: health risk communication, rumour spreading in the mass media and the media effects on perception of vaccination. These were largely criticisms of the response of the media however some examples of success were also noted. Ghersetti et al. [123] applied Bordieu's theory of social capital to explain why Sweden's media was so successful in influencing the public to vaccinate. They note that social capital in the form of education, class affiliation and profession along with the associated media consumption for these groups affected trust in the authorities and thereby their intention to vaccinate.

There are still many areas of global health media communication where these insights have not been implemented to their full potential. The battle against AIDS has faced constant difficulty with translating thoroughly researched media campaigns into real world results. McDonnell [124] reports that outside of controlled research environments AIDs media campaigns are often distorted and repurposed by the public to promote competing agendas in ways which would be impossible to predict through current social science frameworks. Despite such limitations, in the current global landscape of economic crises, pandemic outbreaks and changing political leadership, social science insights will prove more important than ever to inform effective messaging through global health media.

1.8. Online Public Engagement in Global Health

A picture of global health public engagement emerges where significant media reach must be combined with sensitive messaging rooted in social science [125], as well as follow up and interaction with the community in which behaviour change is to be affected [126]. Herein a key limitation of mass media public engagement campaigns is revealed. Television and Radio are for the most part a one-way form of communication. Considering that the NCCPE emphasizes the two-way nature of effective Public Engagement, new online approaches may prove more effective in this respect. Online platforms allow for immediate feedback and engagement with the public through interactive elements such as surveys, e-mail correspondence and social media. Social Science research emphasises the importance of relationships among community members as a key factor in behavioural change [127]. Online campaigns can instigate conversations and action among communities in a way that one-way radio and television communication cannot.

Additionally, the barriers to access and cost associated with online campaigns are considerably lower. Digital analytics allow for precise tracking of campaign goals and a deeper understanding of which features of a campaign are working. Online digital advertising allows a researcher to target a highly specific audience with media information, bypassing many geographic and socio-economic restrictions associated with traditional mass media approaches [128, 129]. The cost of engaging the public in this manner is very low and budgets can be utilised with great efficiency. For example a video summarising the findings of a research project relevant to Asthma sufferers could be highly targeted to an audience through Google Ads. This audience can be defined by hundreds of factors including age, sex, location and search preferences ("Asthma advice" "Inhalers" "Difficulty breathing" etc.) for less than 30 pence per view. In this way every penny spent gets the information in front of the relevant audience in a direct manner.

These advantages address the three main concerns of the 2015 Public Engagement Consortium report [20]. They make public engagement impact measurable, the automation saves time for busy researchers who currently view public engagement

only as a duty and the digital tools make public engagement simpler for researchers who are finding it difficult to fully adapt to the online media landscape.

In recognition of this changing landscape, The Academy of Medical Sciences 2016 report to the House of Commons advises: "Science communication should target the broadest possible audience, requiring innovative strategies to engage hard-to-reach groups". [33]

1.9 Effective Approaches to Public Engagement in Global Health Through Online Video Campaigns

1.9.1. Video and Crowdfunding

Global fiscal austerity measures and increasing competition are driving some global health scientists to seek crowdfunding as an alternative means of financing research [130]. Crowdfunding holds the promise of fueling greater innovation in global health research by providing alternative funding for innovative projects that would not appeal to traditional funding bodies. Freedom from the time constraints of grant cycles could allow for faster innovation and evolution of technology. Established funding models are well suited to high impact large-scale health campaigns, but do not often encourage the kind of disruptive innovation the technology start-up world facilitates. The average age at the first grant award from the National Institutes of Health is 42 for PhDs [131]. In contrast, the average age of a start-up founder in Silicon Valley is 31 [132]. Crowdfunding has the potential to democratise scientific research, but there is also the danger that it may tend to fund so-called "panda-projects", which appeal emotionally to the crowd but have less scientific merit.

The majority of current global health crowdfunding is based around sponsoring doctors and treatments in low and middle income countries through existing non-profit structures. This method is often referred to as crowd-sourcing. The primary appeal of this model is the transparency that allows a donor to see exactly where every penny of their donation is spent as they are put in touch with the doctor they sponsor. The founders of these projects agree that the main appeal of their model is transparency [133, 134]. The donors are sent updates directly from the doctor providing treatment

on the progress of the patient. In all of these models 100% of the money donated is spent directly on patient treatment.

Watsi [133] and Crowd Fund Health [134] are 2 examples of crowdfunding platforms which identify low-cost, high-impact treatments, crowdfund the cost and partner with a medical service provider to deliver the treatment.

Kickstarter, the world's leading crowdfunding platform, is driven primarily through the viral sharing of campaign videos. Campaigns using a video are 66% more likely to be funded than those without [135]. Most global health crowdfunding platforms use video to support their campaigns. However, there is currently no research on what constitutes an effective video.

There are many blog articles that attempt to break down which features contribute to success of crowdfunding videos, but few are backed by the kind of social science research that has been a characteristic of previously successful media campaigns in global health.

1.9.2. USAID's First Public Engagement Campaign

Many large international agencies, bilateral agencies, non-governmental organisations and higher education institutions have also embraced use of online video in their campaigns over the last decade. In 2011 USAID launched the FWD online campaign in an effort to raise public awareness of famine in the horn of Africa [136]. The campaign focused on three main objectives:

"Deliver results on a meaningful scale through a strengthened USAID…Promote sustainable development through high-impact partnerships and local solutions…Identify and scale up innovative, breakthrough solutions to intractable development challenges." [137].

The campaign created direct engagement with the U.S public through a television campaign, social media campaign and special events. The project is regarded as a highly

effective intervention raising over $5 million in private donations and leveraging billions more worldwide through new and existing partnerships. The campaign had a significant social media impact, generating 150 million "forwards", page-views, "likes" and friends through Facebook, re/tweets on Twitter, and YouTube views [137]

FWD was clearly a huge success and yet the impact of the campaign is difficult to measure in any objective sense. In reference to the campaign, Abdullateef comments "While these campaigns frequently enjoy success, the effectiveness of measuring "public engagement" has been an ongoing challenge" [137]. Abdullateef views grounding in social science as a key factor of the success of the project. The campaign sought to identify leaders in the targeted social groups and reach them first as opposed to the "scatter gun" promotion of many other campaigns.

If similar positive results are to be obtained by further global health public engagement campaigns, then key metrics in online public engagement would help to to facilitate goal-setting and analysis.

1.9.3. WHO Social Media Campaigns

The WHO has launched several social media campaigns over the past 3 years. In 2016 it launched "Get Healthy" in order to "engage the Chinese public in a conversation about how a healthy lifestyle can help guard against disease" [138]. The study, hosted on micro-blogging platform Weibo shared basic healthy eating advice through pictures and videos. A similar campaign on Weibo was launched in 2015 called "Got it Covered" with an aim to share safe sex information with college and university students [139].

The WHO has incorporated social media activities into its Global Vaccine Action Plan. World immunisation week online engagement activities include an online quiz, infographics, video, twitter chat and Facebook Q&A. However the objectives in the Global Vaccine Action Plan are quite vague, stating only that: "New efforts could take advantage of social media and approaches used by commercial and social marketing efforts to promote immunization and address concerns." [140]

1.9.4. Global Health Media Project

The Global Health Media project has made possibly the most significant contribution to the use of online video in global health [141]. Their videos have received a total of 13 million views world-wide as of September 2016 clearing demonstrating the need for well-produced global health video content [142]. Their work falls into 2 main categories: 1. Training videos for health care workers and 2. Short films which raise awareness of key global health topics. Their most popular short film "The Story of Ebola" produced in collaboration with the International Federation of Red Cross and Red Crescent Societies and The United Nations Children's Fund, is a short, animated video over 1 million views [143]. And their most popular training video is a video on increasing milk supply in the Swahili language, with over 6 million views [144]. Their work highlights 2 clear needs in global health which can be served by video: awareness raising films for important global health issues and instructional videos for healthcare workers. The videos are used by primarily by NGOS (40% of video downloads), teaching institutes (23%) and health facilities (14%) [145].

An analysis of the factors leading to the success of such popular global health videos could contribute to setting best-practice guidelines for global health organisations who wish to engage the public on similar topics.

1.9.5 Gaps in knowledge of public engagement in global health

This review of the literature reveals three key gaps in the understanding of determinants of effective online public engagement in global health.

1. The mixed results of traditional mass media campaigns in global health emphasise the calls for more research on message content from social scientists. A framework for effective message content would benefit many organisations in global health in both raising awareness of key issues and creating behaviour change in the public.

2. Online video is the most important communication tool of many modern global health public engagement projects holding a primacy in both crowdfunding and social

media campaigns. Therefore, it is surprising to find no formal research on what constitutes effective video content in global health.

3. Only one study in this literature review considered important metrics to track in global health social media campaigns [55]. Compared with the sophistication with which commercial marketing campaigns are carried out with hundreds of key metrics tracked; global health campaigns are far less intentional in their approach.

There is a clear need to investigate which video features are effective in global health online public engagement. Success will be defined through key video marketing metrics and tracked in order to isolate effective content features.

Chapter 2:

Aims and objectives

2.1. Aims

Efforts in global health and development have broad political support and substantial financial commitment from most governments, but this support could be greater if global health issues featured more prominently in public debate. However, it has proven quite difficult to make global health issues attractive for viewing and engaging with, as compared to various forms of entertainment or public debates in the media. The review of effective approaches to public engagement in the introductory part of this theses identified several approaches that could work for global health topics but most of these were related to mass media and not online campaigns.

The aim of my research is to develop an engaging documentary on global health that will cover a wide variety of topics and track engagement with it. This 2-hour material will be split into 10 episodes of similar length which will be shown to large audiences on social networks, online news portals, YouTube and if possible television broadcast. I aim to carefully document the reception of each of the 10 episodes by these audiences and conduct analyses of rich datasets provided by Facebook, YouTube and larger media analytics to explore if there are any effective approaches that could bring global health issues into the focus of the public debate and reach large audiences.

I aim to study the engagement of the documentary material on global health through carefully designed studies that allow comparisons between the 10 episodes under similar conditions. Conducting these studies should answer a number of research questions, such as: (i) are there topics in global health that are clearly more interesting to large general audiences than other global health topics, and why?; (ii) are there styles of presentation of global health topics that are likely to lead to greater level of engagement from general audience and what are they?; (iii) what are the characteristics of audiences that are the most interested and receptive to global health content?; (iv) which medium is optimal for disseminating global health knowledge, information and messages to large general audiences and are there important differences between different media used?

2.2. Objectives

To the best of my knowledge, no studies have determined factors that could affect engagement with global health videos on social media. In this study, I will develop a 10-episode global health documentary funded by the University of Edinburgh Wellcome Trust ISSF scheme. These videos will also be able to serve as a massive open online course (MOOC). In each episode I will vary the topics, styles of presentation and the music.

I will then publish each episode on the personal Facebook profile of the narrator and follow its progress on social media and any other news or media websites which may share it. I will explore whether the differences between the episodes could inform strategies for promoting global health-related videos online.

I will then repeat the same study by publishing the 10 episodes on a YouTube channel and allow viewers on YouTube to watch the content for around 2 years and draw conclusions on their interest. I will also conduct a paid YouTube campaign to a large audience (nearly 200,000 people) and use YouTube analytics to draw further conclusions. I will then compare how the results from social networks and online news websites compare with the YouTube studies.

Finally, I will repeat the same analysis if possible- based on a screening of this documentary series on a national television channel over a number of weeks. Making use of the higher view counts I will compare the analyses of the uptake of each episode with the two previous analyses. This series of studies should lead to robust conclusions on effective strategies for engaging the general public with global health topics.

Chapter 3:
Materials, Methods and Study Designs

3.1. Development of the YouTube Channel / MOOC / Documentary Series "Survival: The Story of Global Health"

Following a successful application for the ISSF fund in the amount of GBP 20,000, my supervisor Professor Igor Rudan and I engaged in the development of the documentary series “Survival: The Story of Global Health” in order to promote his health messaging. During the first seven months of 2017 Professor Rudan wrote the scripts for the videos and I created the videos based on these by directing, filming and editing the media materials.

It was a privilege to promote the health messaging of Professor Rudan who is a highly respected and internationally renowned global health scientist. Professor Rudan is a global health expert who has made a tremendous impact on many diverse areas of global health research. He is recognised in the Croatian media as the country’s leading intellectual figure and thought leader on matters of science and health and has received many prestigious awards and recognitions for his work further detailed in his Royal Society of Edinburgh bio copied below.

The public engagement campaign was carried out among Professor Rudan’s large following on Facebook consisting of 450 friends and 800 followers when the promotion began. The value this brought to the research is that it provided a real-world scenario promoting real health messaging from a real global health authority on his personal social media account. While Professor Rudan had a much larger following than the average researcher during the study the lessons learned on the journey to reaching an audience of several million should be applicable to researchers beginning from an audience of any size seeking to share their work through the medium of video.

Throughout the study we formed an effective collaboration where Professor Rudan wrote the scripts for all videos based on his global health expertise and I filmed, produced and directed the videos, promoting them through Youtube, Youtube Advertising, Facebook and eventually seeing them reach national television exposure.

Professor Rudan's full bio from The Royal Society of Edinburgh's website is copied below for reference:

"Professor Igor Rudan is committed to advancing biomedical sciences and reducing global child mortality and has published more than 430 research papers and 7 books focused on global maternal and child health and the genetic basis of human disease. In 2001, Igor founded a biobank in isolated populations of Croatian islands, which has contributed to the discovery of biomedical role for more than 1,000 human genes to date. In an effort to reduce global child mortality, he has served as a consultant of the World Health Organization, UNICEF, The Bill and Melinda Gates Foundation, The World Bank, Save the Children, as well as many others. Igor has developed several methods that have been widely used by international organisations to prioritise investments in global health and development, and has been awarded 20 national and international research awards and professional recognitions." [146]

The series now also serves as a high production quality MOOC and contains 10 educational videos on major global health topics. Descriptive details of each episode, including the title of each episode, a brief summary of content, duration, predominant style in which the episode was made (classic documentary movie, dramatic narrative, artistic narrative or animated narrative) and the link to each episode on YouTube are available in **Table 1**.

The series "Survival: The Story of Global Health" consists of 10 educational videos on major global health topics. The topics were: (i) the human population's survival and persistence; (ii) maternal and child health; (iii) communicable diseases; (iv) epidemics and pandemics; (v) non-communicable diseases; (vi) ageing and dying; (vii) international organizations involved in global health; (viii) the UN's Millennium Development Goals and Sustainable Development Goals; (ix) Equity and Inequality; (x) the future of global health and development. These episodes varied in duration from 7 min 58 secs to 19 mins 50 secs, with the majority lasting between 10 and 15 minutes.

3.2 Overview of Studies

The studies in this thesis form a public engagement campaign to promote the "Survival: The Story of Global Health" videos all the way from basic social media promotion to national press coverage and large audiences on YouTube, to nationally televised mass media exposure with over one million views.

Four methods of engagement were used throughout the studies: Facebook sharing, posting to YouTube without advertising, posting to YouTube with advertising and finally national television promotion. These methods were chosen in order to reflect the primary methods of public engagement identified in the literature review: organic social media sharing, social media advertising and mass media promotion.

In the first study each episode of the video series was posted to Facebook and the available engagement metrics of likes, shares and comments were tracked. Their spread through online newspapers was then further analysed. In the second study the episodes were posted to YouTube and engagement metrics such as views, likes, dislikes, comments and average view duration were tracked and analysed. In the third study the episodes were advertised through YouTube to large audiences and the engagement metrics were tracked with the addition of the availble demographic data. Finally in the fourth study metrics from a national television screening of the video series with over one million views were tracked an analysed.

Each study builds on the previous one increasing the audience size at each stage. This allows for some insight into the mechanics driving the spread of global health public engagement material from a small social media promotion to mass media exposure. I chose to study engagement primarily through Youtube because this is the most popular platform for online video and as the literature revealed there is a lack of research on how the global health community can use this platform. The YouTube videos were shared through Facebook in the first study as this was the platform on which Professor Rudan had the largest following.

3.2.1 Variables

The variables used in the analyses varied depending on which were available through the social media platform and the method of promotion. In the case of Facebook promotion likes, shares and comments were the available metrics on the platform.

The Croatian television data was generated by AGB Nielsen a broadcasting analytics company. All available data from AGB was reported. While it is difficult to compare metrics from national television to social media the average percentage of the episode viewed on television can be be converted and compared to the average view duration on YouTube.

In the case of the studies involving YouTube the primary metrics which track direct interaction (views, likes and dislikes) were tracked in all studies. Where they were available additional metrics such as average view duration, peaks in viewership, new subscribers and demographics data were tracked to give deeper insight into the quality of engagement. These additional metrics and demographic data are only available at the discretion of YouTube after the video reaches a certain level of traffic according to YouTube internal algorithms. They were reported wherever they were made available by YouTube throughout the studies.

Youtube advertising provides demographic data for all videos as standard so in the advertised study additional demographic data on age, gender, income brackets, parental status were also included. Throughout the studies I maintained phone contact with Google support to ensure we were receiving all available metrics for the videos.

3.2.2 Assessment of Presentation Style, Mood of Music and Emotional Valence

The music was sourced from one of the most popular music websites on the internet "AudioJungle.com". Audiojungle categorises music using tags describing characteristics of the music. We searched for pieces according to their mood such as "dramatic" or "sad". The mood of the music was assessed objectively according to its tag on Audiojungle.com.

The video presentation style was assessed as either classic, dramatic, animated or artistic. The assessment criteria for each of these definitions is given below.

Animated: The episode contains primarily animated footage as opposed to real film.
Dramatic: more than 50% of the video duration contains images or videos containing depictions of peril or action.
Artistic: The video contains creative visual effects beyond simple cuts and edits throughout.
Classic: The video consists of simple video edits with music and speech in a documentary format.

The emotional valence of videos categorised as positive or negative was assessed as follows:

Positive: More than 50% of the episode script describes solutions to problems and human achievement.
Negative: More than 50% of the script describes human problems and crises.

3.3. A Study Promoting the "Survival: The Story of Global Health" through a Social Network and Online Newspaper Websites

Between Aug 1, 2017 and Sept 30, 2017 we posted each episode with a brief background text on the Facebook profile of the narrator, who had an average of 450 friends and further 800 followers throughout the period of study. We studied the interaction of Facebook friends and followers with each posted video, tracing the number of "likes", "shares" and "comments". The dates of posting, the number of "likes", "shares" and "comments" are presented in **Table 2**.

Moreover, since the narrator has a Facebook following primarily from his home country of Croatia several popular Croatian online news portals (Telegram.hr, Index.hr and Liberal.hr) with between 100,000 and 500,000 daily viewers chose to share some of these stories from those public Facebook posts. Their websites tracked the number of views, shares and comments, which we monitored and recorded (**Table 2**). The

resulting effects of those interactions on YouTube views of the featured videos were recorded and analysed using YouTube Analytics (**Table 2**). We recorded the number of YouTube views five days after the initial Facebook post. We also documented the number of "likes" and "dislikes" received for each YouTube video, and the number of subscribers to the YouTube channel "Survival: The Story of Global Health" that each of the 10 videos attracted. We also recorded the average viewing duration for each video, retention of viewers after 1 minute of each episode, number of shares on YouTube, number of peaks in the number of viewers over the duration of each episode, and the content that most likely caused the peak (**Table 2**).

3.4. Two Studies Promoting the "Survival: The Story of Global Health" through an open YouTube Channel and closed YouTube Advertising

We conducted the study in two separate samples of viewers. The first one was based on creating the YouTube channel named "Survival: The Story of Global Health" between Aug 30 and Sept 30, 2017 and leaving it for viewers to find and watch. By June 30, 2019 this approach attracted 41,305 viewers. The second study was more controlled and conducted with private YouTube videos that were not available to the general public and the videos were advertised to potential viewers. This attracted 188,154 viewers and captured viewers' behaviour using YouTube Analytics.

I investigated the nature of engagement through the following variables and demographic data.

Engagement Variables:

(i) number of views; (ii) number of "likes"; (iii) number of "dislikes"; (iv) number of shares (v) number of comments (vi) number of features by online news media (vii) number of shares from online news media (viii) number of comments on online news media (ix) number of new subscribers (x) average view duration as an absolute value (xi) average view duration as % of video length (xii) clicks to find out more (xiii-xvii) rentention rate (4 strata) (xviii)% who viewed more than 1 minute (xix)

peaks in viewership (xx) content related to peaks in viewership (xxi) view rate (xxii) views lasting more than 10 seconds.

Demographic Characteristics:

(i) viewers' age; (ii) viewers' gender; (iii) viewers' income; (iv) viewers' parental status; (v-x) income percentile of the population (5 strata).

Based on these parameters, I was able to explore differences in behaviour of the viewers across the 10 videos, assuming that the diversity of topics would necessarily lead to notable differences between the 10 videos.

3.5. Data-Rich Analysis based on Airing of the Series on Croatian National TV

Data-rich analytics of the airing of 10 episodes on Croatian National TV programme 1 at peak time were generated by AGB Nielsen and they are protected by confidentiality agreement between AGB Nielsen and Croatian TV. We obtained this data due to courtesy of Ms Sanja Limov, Mr Vladimir Brnardic and Mr Renato Kunic from the Documentary Programme section of the Croatian Television, who enabled us to use this data with a restriction that they are used solely for the purpose of the research for this PhD thesis. I am grateful to all of the aforementioned parties.

The parameters that I was able to obtain are presented in **Tables 8-10**, **Figure 1** and **Appendix 2**. Parameters available for each episode in **Table 8** were: TV company airing the episode and channel, date and time the episode was aired; average proportion of the total Croatian population watching each episode; proportion of total Croatian population watching television at the time; average proportion of all active viewers watching each episode at the time; total number of viewers tuning into each episode over the entire duration of the episode; average number of viewers of each episode over the entire duration of the episode; average proportion of each episode's duration viewed by each active viewer; percentile rank among all daily shows of any type; percentile rank among all viewers; and percentile rank among all shows among 18-59 years.

Further parameters which allowed the construction of **Figure 1** were the absolute number of viewers watching each episode during each minute. **Table 9** is based on the number of viewers who were common to each possible pair of episodes. **Table 10** is based on a detailed demographic analysis for the total reach of 1.404.706 cumulative viewers on Croatian Television Channel 1.

The parameters here included: Settlement Size (More than 5.000 inhabitants / Less than 5.000 inhabitants); Region (Zagreb / North Croatia / Slavonia / Lika i Banovina / Hrvatsko Primorje / Dalmatia); Income (Low / Middle / Upper / Higher); Sex (Males / Females); Age group in years (4-9 / 10-14 / 15-19 / 20-24 / 25-29 / 30-34 / 35-39 / 40-44 / 45-49 / 50-54 / 55-59 / 60-64 / 65+); Education (Elementary and no education / High school / University and college); data for some specific age groups in years (10-17 / 18-24 / 25-34 / 35-49); number of TV sets owned (1 TV set / 2+ TV sets); life style (Unknown / Hard life / Routine based / Family oriented / Loaded with obligations / Open minded / Fun seekers); Social Class (Rural lower class (retirement age households) / Urban lower class (retirement age households) / Rural middle class (family type households) / Urban lower-middle class (blue collar households) / Urban higher-middle class (white collar households)).

Finally, detailed data presented in **Appendix 2** show for each episode: proportion of the total population watching each TV channel in Croatia on each day, proportion of all active viewers watching each TV channel in Croatia and daily statistics for all programmes on Croatian television on 19 Sep 2018 that were viewed by at least 1% of total population.

Chapter 4:
Results

4.1. A Study Promoting "Survival: The Story of Global Health" through a Social Network and Online Newspaper Portals

Table 1 provides information on the 10 episodes related to global health topics that we developed. The 10 themes covered by these episodes were: (i) Survival of the human population to modern times; (ii) Maternal, newborn and child health; (iii) Infectious diseases, particularly malaria, tuberculosis and HIV/AIDS; (iv) History of pandemics, epidemics and new pandemic threats of the 21st century; (v) Non-communicable diseases; (vi) Ageing and dying; (vii) International organizations and philanthropic foundations in global health; (viii) UN's Millennium Development Goals and Sustainable Development Goals; (ix) Issues related to inequality, equity and universal health coverage; and (x) The future of global health and the likely challenges to long-term survival. The duration of these episodes ranged from 7 min 57 seconds (Episode 2) to 19 min 49 seconds (Episode 4).

To gather as much information as possible from this study I also varied the styles in which different episodes were produced: four episodes (numbers 1, 2, 3 and 7) were produced in the style of a classical documentary movie; four episodes (numbers 5, 6, 9 and 10) in varied artistic styles; one episode (number 4) in a dramatic narrative style, while one episode (number 8) was mostly animated. This gave us a range of combinations of content, episode duration and production styles that we could analyse for their success in being shared online.

Table 1. Description of the 10 episodes from the documentary series (and MOOC) entitled "Survival: The Story of Global Health". The table provides a title of each episode, a brief summary of content, duration, predominant style in which the episode was made (classic documentary movie, dramatic narrative, artistic narrative or animated narrative) and the link to each episode on YouTube.

Episode number	Title	Content summary	Duration (min:sec)	Style	YouTube link
Episode 1	How did we avoid extinction?	Survival of human species to modern times	9:10	Classic	https://www.youtube.com/watch?v=LhDoS6T6DHA
Episode 2	Women and children first	Maternal, newborn and child health	7:57	Classic	https://www.youtube.com/watch?v=CrfxgzAi_3o&t=31s
Episode 3	Invisible friends and visible enemies	Infectious diseases, particularly malaria, tuberculosis and HIV/AIDS	15:22	Classic	https://www.youtube.com/watch?v=wo6ocbDjyeo&t=39s
Episode 4	Keeping our enemies closer	History of pandemics and new pandemic threats of the 21st century	19:49	Dramatic	https://www.youtube.com/watch?v=yM-92ZYjTxQ&t=38s
Episode 5	Our private diseases	Non-communicable diseases globally	14:47	Artistic	https://www.youtube.com/watch?v=9STZq5uAAYI&t=19s
Episode 6	Are ageing and dying inevitable?	Biological limits to human lifespan and related biotechnological advances	15:18	Artistic	https://www.youtube.com/watch?v=YAKc4N_GBvs&t=62s
Episode 7	Who rules the new world of global health?	International organizations and philanthropic foundations in global health	8:40	Classic	https://www.youtube.com/watch?v=1mCUBDrvTwM&t=27s
Episode 8	Agreeing on goals for humanity	UN's Millennium Development Goals and Sustainable Development Goals	8:50	Animated	https://www.youtube.com/watch?v=IX7PH8ofmGk&t=21s
Episode 9	Leave no-one behind	Issues related to inequality, equity and universal health coverage	9:11	Artistic	https://www.youtube.com/watch?v=u0JejcRIDA0&t=25s
Episode 10	Could we make it to the end of time?	The future of human species and the likely challenges to long-term survival	13:27	Artistic	https://www.youtube.com/watch?v=CAiq1KdgRzU&t=708s

Table 2. The outcome of posting of each episode on personal Facebook profile, which took place between 1 Aug and 5 Oct 2017. (Abbreviations: FB=Facebook; ONP=Online News Portal; YT=You Tube; TB=tuberculosis; BMI=body mass index; CRISPR=gene-editing tool in molecular biology)

	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5	Episode 6	Episode 7	Episode 8	Episode 9	Episode 10
Date posted on FB	26 Aug 17	29 Aug 17	01 Aug 17	05 Aug 17	01 Sep 17	19 Sep 17	14 Sep 17	18 Sep 17	21 Sep 17	22 Sep 17
Likes on FB	274	171	65	226	246	143	112	95	123	89
Shares from FB	57	16	2	124	34	11	11	11	18	2
Comments on FB	14	10	0	12	17	9	4	0	11	4
Featured by ONP	Yes (1)	No	No	Yes (3)	Yes (1)	No	No	No	No	No
Shared from ONP	164	0	0	2820	257	0	0	0	0	0
Comments on ONP	8	0	0	111	29	0	0	0	0	0
Views on YT (5 days)	1263	108	123	9784	270	201	166	135	171	107
Likes-dislikes on YT	21-0	0-0	3-0	43-2	4-0	12-0	0-0	2-0	3-0	3-0
Shares from YT	14	0	1	69	2	1	0	1	4	3
Subscribers on YT	5	0	2	20	0	0	0	1	0	0
Average view on YT	2:58	2:54	3:54	4:44	2:38	4:48	2:41	2:47	3:12	4:02
Viewed 1 min on YT	48%	42%	42%	51%	38%	48%	43%	53%	47%	36%
Peaks in view on YT	1	1	2	0	2	1	0	2	1	3
Content related to each peak in view on YT	Narrator appears	Script begins	Malaria cycle; TB treatment	None	Food and BMI; Franken-stein pub	CRISPR	None	Global agenda; Poverty reduction	Inequality agenda	Narrator appears

Table 2 shows that we posted the episode on a personal Facebook profile with an average of 450 friends and 800 followers during the period of study, i.e. between 1 Aug and 5 Oct 2017. The 10 Facebook posts were liked between 67 and 258 times on the Facebook profile, and shared between 3 and 123 times, receiving between 0 and 27 comments. Nearly all of the comments were very supportive and complimentary, but there was a clear difference between uptake rates of different episodes.

Three episodes clearly stood out in terms of popularity on Facebook: Episode 1 on the survival of the human species (274 likes and 57 shares), Episode 4 on historic and modern pandemics (226 likes and 124 shares) and Episode 5 on non-communicable diseases (246 likes and 34 shares). Those levels of interest trigged "detection of viral content" tools at the three online new portals in Croatia: Telegram.hr (around 250,000 visits per day), Index.hr (more than 750,000 visits per day) and Liberal.hr (around 100,000 visits per day). The first one, Telegram.hr, featured all three posts and turned them into a story on their news portal. Index.hr and Liberal.hr only picked Episode 4, which clearly stood out in terms of interest from mainstream online media.

Once the three episodes were featured by online media portals, the number of their views and shares increased quite dramatically in comparison to Facebook-based promotion alone. From the position where only 1,250 friends and followers could theoretically engage with the content, exposure of three episodes in the online news portals increased the number of potential viewers to 250,000 for Episodes 1 and 5, and to more than 1 million for Episode 4. Tracking of interaction with the story showed that Episode 1 was shared on Facebook 164 times (in addition to 57 original shares) and raised 8 further comments; Episode 5 was shared 257 times (in addition to original 34) and raised 29 further comments; while Episode 5 was shared 2,820 times (in addition to original 124) and raised 111 further comments (**Table 2**).

All of these developments led to further viewing of the 10 videos on YouTube, which we also recorded and analysed. As expected, the seven episodes that

weren't further shared by the online news portals and which had Facebook as their only means of dissemination (i.e., episodes 2-3 and 6-10) assembled between 107 and 201 YouTube views. This number is typically about 30-50% larger than the number of likes that each Facebook post received, which means that the number of actual viewers was larger than the number of those who liked the Facebook post. This observation created a consistent base for expected interaction from a Facebook post. However, the impact of the remaining three episodes, which were further shared by online news portals, were different: Episode 5 received 270 YouTube views, Episode 1 received 1,263 views, and Episode 4 received as many as 9,784 views in 5 days (**Table 2**).

The most viewed episode (Episode 4, on pandemics) also attracted the most "likes" on YouTube (43) and most "shares" (69), but also 2 "dislikes", which were the only such cases. No other episodes received a dislike on YouTube. The number of "likes" was also quite high for Episode 1 on human evolution (21), which also had 14 "shares" from YouTube, while the Episode 6 on ageing and dying received 12 "likes" and only 1 "share". Other episodes received between 0 and 4 "likes" and 0 to 4 "shares". In terms of attracting new subscribers to the YouTube channel "Survival: The Story of Global Health", Episode 4 attracted 20 subscribers, Episode 1 further 5 subscribers, while all other episodes combined have only managed to attract 3 subscribers (**Table 2**).

The average viewing time on YouTube ranged from 2:41 mins (for Episode 7 on international organisations) to 4:48 mins (for Episode 6 on ageing and dying). Episode 4 on pandemics also did better than most other episodes, with an average viewing time of 4:44 mins, thus very nearly topping the list. However, a clear message from this analysis is that the average viewing time was much shorter than the total duration of each episode and that the drop-out rate during the course of the video might be quite high. This finding prompted further analyses to explore the patterns of viewers' dropping out. It was shown that between 36% and 53% of viewers are still present at the end of the first minute of each video, meaning that 47-64% of all viewers would drop out within the first minute (**Table 2**). We also identified peaks in viewership at specific times in

an episode. The number of peaks ranged from 0 to 3 per episode. They were related to the narrator appearing, script starting, malaria parasite cycle, treatment for tuberculosis, CRISPR technology, link between food and BMI, agenda on poverty reduction and inequality.

Overall, it is clear that the 4th episode raised the most attention, views and shares. It was the episode on the history of pandemics, which was the only one filmed in dramatic narrative style, and also the longest episode. The topics that didn't raise much interest were those more specific to global health - maternal and child mortality, major infectious diseases, international organizations, equity and Millennium Development Goals.

4.2. Two Studies Promoting the "Survival: The Story of Global Health" through an open YouTube Channel and closed YouTube Advertising

The results of the first study are shown in **Table 4**. The table shows the number of views, likes, dislikes and the rate of likes per views that resulted from posting 10 videos on a YouTube channel called "Survival: The Story of Global Health". Over a period of just under 2 years all videos together attracted 41,305 views. There were clear and substantial differences in interest in different topics which were more than 10-fold. The most popular video, Episode 4 on epidemics and pandemics, attracted 14,594 views and it was followed by Episode 1 which attracted 10,761 views. Those videos were presenting content that was of clear popular interest among the general population. At the opposite end, Episode 6 on ageing and dying attracted 1,110 views and Episode 10 on the future of global health and development attracted 1,375 views. The other 6 episodes ranged between 1,541 and 3,117 views, showing that Episodes 4 and 1 were real outliers in terms of generating public interest.

The analysis of the "likes" and "dislikes" showed that topics in global health were far more likely to attract likes, which is not surprising. In 41,305 views, we only recorded five dislikes. Three of them were related to Episode 4. Since this episode was presented in the context of promoting the value and importance of vaccines, it is quite possible that those rare dislikes were left by viewers who supported anti-vaxxer views. Table 1 provides both - the total number of likes and the ratio of likes per views. According to this parameter, the most actively liked video was Episode 6 on ageing and dying, whose ratio of likes per views was 2.16%. It was followed by Episode 10 on the future of global health and development with a ratio of 1.67% and Episode 5 on non-communicable diseases with 1.25%. At the other end, Episode 4 on epidemics and pandemics had a ratio of 0.55%, while Episode 9 on inequality and equity had 0.58%. Other episodes achieved a stable ratio of between 0.80% and 1.11%. This analysis implies that there were marked differences in the ratio of

likes per views and that the videos that were watched the least seemed to have the highest ratio of likes per views possibly indicating a higher level of engagement but from a smaller subset of the total viewers.

The results of the second study are shown in **Tables 5-7**. Despite the relative uniformity of results driven by mass audience behaviour there were some striking differences between the 10 videos in the parameters analysed through YouTube Analytics. The same budget was allocated to each episode and I ensured exactly the same settings for every aspect of each campaign - including the run-time of the advert for each of the 10 videos. Still, the YouTube algorithms assigned views differently to the 10 videos, leading to substantial differences in the initial number of views, albeit less striking than those observed in the first study. The difference here between the most and the least viewed videos was only 2-fold, while in the first study they were 13-fold. The most viewed was Episode 3 on communicable diseases with 31,026 views and the least viewed was Episode 8 on the UN's Millennium Development Goals and Sustainable Development Goals with 13,984 views. As these differences arose entirely from the allocation and advertising campaign performed by YouTube algorithms, we cannot explain why these differences arose. Still, it is reassuring that the majority of videos received between 14506 and 20388 views and they were quite comparable in that sense.

The most interesting question of this study was the result shown in the 3rd column of Table 3, i.e. the view rate for each video. This parameter was derived as the number of views that lasted beyond 10 seconds divided by the total number of views. Given that each of the 10 videos mainly displayed the title of the episode, using the same design in the background, this column is a direct indication of the interest of a larger number of diverse online viewers in the topic covered by each video. There were, again, marked differences in view rates. The video capturing the largest audience was Episode 2 on maternal and child health (with a view rate of 18.90%), followed by Episode 7 on international organisations in global health (view rate of 16.83%). At the

bottom of the rank were Episode 6 on ageing and dying (view rate of 13.83%) and Episode 5 on non-communicable diseases (view rate 14.59%).

Table 4: Number of views, likes, dislikes and the rate of likes per views that resulted from posting 10 videos on a YouTube channel called "Survival: The Story of Global Health".

	Views	Likes	Dislikes	Likes per views
Episode 1	10761	101	0	0.93%
Episode 2	3117	26	1	0.83%
Episode 3	2793	31	0	1.11%
Episode 4	14594	80	3	0.55%
Episode 5	1600	20	1	1.25%
Episode 6	1110	24	0	2.16%
Episode 7	1541	13	0	0.84%
Episode 8	1988	16	0	0.80%
Episode 9	2426	14	0	0.58%
Episode 10	1375	23	0	1.67%

Table 5: YouTube Analytics results of the study conducted within the closed YouTube channel where the videos were advertised to potential viewers.

	Views (Started viewing)	Views (at least 10 secs)	View rate (topic of interest?)	Avg view duration (minutes)	Avg view duration (%)	Clicks ("find out more")	Retention (Percentage watching at 25%)	Retention (Percentage watching at 50%)	Retention (Percentage watching at 75%)	Retention (Percentage watching at 100%)
Episode 1	19614	3183	16.23%	3.14	35.1	62	6	4	3	3
Episode 2	20388	3854	18.90%	3.28	43.3	74	9	6	5	4
Episode 3	31026	4922	15.86%	4.55	32.0	114	5	4	3	3
Episode 4	17351	2552	14.71%	6.00	30.2	47	4	3	3	2
Episode 5	25367	3702	14.59%	4.37	31.4	95	5	3	3	2
Episode 6	14506	2006	13.83%	5.15	33.5	46	5	4	3	3
Episode 7	14718	2477	16.83%	3.27	39.9	45	7	5	4	3
Episode 8	13984	2171	15.52%	3.41	41.6	49	7	5	4	3
Episode 9	16499	2439	14.78%	3.58	43.2	56	5	5	4	4
Episode 10	14701	2351	15.99%	4.45	35.3	55	6	4	3	3

Table 6: YouTube Analytics results of the study conducted within the closed YouTube channel where the videos were advertised to potential viewers.

	% aged 18-24	% aged 25-34	% aged 35-44	% aged 45-54	% aged 55-64	% aged 65+	% Unknown age	% female	% male	% unknown gender
Episode 1	23.97	28.36	17.24	9.42	5.65	3.29	12.03	32.95	57.96	9.07
Episode 2	24.10	27.86	17.90	8.82	5.52	3.34	12.42	31.44	58.48	10.06
Episode 3	25.07	27.71	18.00	8.63	5.85	3.57	11.15	37.60	54.38	8.00
Episode 4	28.95	28.09	15.43	10.18	5.01	3.56	8.73	34.87	60.93	4.19
Episode 5	25.25	27.74	16.26	10.02	5.07	2.99	12.64	36.11	54.64	9.23
Episode 6	25.12	29.36	16.90	9.52	5.43	3.04	10.56	34.84	58.62	6.53
Episode 7	27.41	27.33	16.39	9.52	6.09	4.11	9.12	34.07	59.50	6.41
Episode 8	25.33	27.17	19.02	9.07	5.29	3.86	10.22	38.73	54.53	6.72
Episode 9	25.33	27.92	17.63	9.84	6.43	3.32	9.51	33.94	59.65	6.39
Episode 10	25.35	29.26	16.75	8.12	6.38	3.19	10.93	35.68	57.29	7.01

Table 7: YouTube Analytics results of the study conducted within the closed YouTube channel where the videos were advertised to potential viewers.

	% unknown income	% in bottom 50% income	% in 41-50% income	% in 31-40% income	% in 21-30%	% in 11-20%	% in top 10%	% parent status	% not parent status	% unknown parent status
Episode 1	69.14	8.79	1.91	2.76	2.79	4.24	10.33	18.34	53.75	27.89
Episode 2	68.73	9.13	2.10	2.90	3.34	4.22	9.54	17.56	53.99	28.43
Episode 3	63.20	14.05	2.60	3.61	3.94	4.67	7.90	25.17	59.04	25.17
Episode 4	78.20	8.43	1.56	2.23	2.01	2.82	5.97	12.57	67.71	19.71
Episode 5	64.70	13.52	2.43	3.05	3.51	4.80	7.91	15.61	58.31	26.06
Episode 6	62.26	13.16	2.24	3.09	4.03	5.03	10.16	15.70	61.06	23.23
Episode 7	60.59	14.85	2.13	3.55	3.35	5.24	10.25	15.26	62.41	22.32
Episode 8	78.30	8.79	1.79	2.30	2.21	2.62	3.96	16.81	58.22	24.96
Episode 9	58.42	15.53	2.58	3.73	3.97	5.24	10.49	15.25	62.68	22.05
Episode 10	63.29	14.37	2.29	2.84	3.82	5.10	8.25	16.88	59.37	23.73

The next parameter I studied was average view duration. This parameter is interesting and useful because it is neither affected by the number of views that each video received nor the duration of the video, which makes it fully comparable across the 10 videos. The topic that retained the audience for the longest time was Episode 4 on epidemics and pandemics (6.00 min), followed by Episode 6 on ageing and dying (5.15 min) and Episode 3 on communicable diseases (4.55 min). Episode 1 on human population survival, Episode 2 on maternal and child health and Episode 7 on international organizations in global health had the shortest retention of viewers, ranging from 3.14 to 3.27 mins. Clicks to find out more about each video ranged from a maximum of 114 for Episode 3 on communicable diseases, which was a real positive outlier, to only 45-49 for Episodes 4, 6, 7 and 8.

The proportion of the viewers still watching the video at 25%, 50%, 75% and 100% is a very useful indicator. It shows that the drop-off rate for the advertised videos on YouTube is very high, as typically as many as 91-96% of viewers would drop off each video by 25% of its total playtime. Episode 2 on maternal and child health seemed to achieve slightly higher retention than other episodes. This shows that it is remarkably difficult to convert advertised videos on global health into committed views and very large number of showings is required to achieve substantive audiences in global health themes. However the 100% completion rates ranged between 2 and 4%, which is not an unreasonable result for an entirely untargeted YouTube campaign and may represent one of the most useful results of this study.

The findings in **Table 6** and **Table 7** are all useful in planning future campaigns, reducing their cost and improving efficiency because they show the demographics of the viewers who were most likely to engage with the content. A careful examination of the differences between the 10 episodes in terms of viewers' gender and age (**Table 6**), income brackets and parental status (**Table 7**) did not reveal any appreciable differences. Even the observed slight differences in income brackets may not be particularly meaningful as

they may be biased by a rather high proportion of those with unknown income.

4.3. Data-Rich Analysis based on Airing of the Series on Croatian National TV

Data-rich analytics of the airing of 10 episodes on the Croatian National TV Programme 1 generated by AGB Nielsen allowed a remarkably detailed analysis of the reception of each episode by a very large audience - more than 1.4 million viewers tuned into at least one of the episodes cumulatively. **Table 8** shows analytics for the first set of parameters on 10 episodes that were aired on Channel 1 of Croatian Television between 19 Sep and 24 Oct 2018. All episodes were aired at a comparable time, i.e. between 8:54 pm and 9:17 pm. **Tables S1, S3, S5, S7, S9, S11, S13 and S15** in **Appendix 2** show that this was the very peak of daily viewership in Croatia, when between 41.3% and 45.1% of the entire Croatian population watched some TV programme. Episode 5 was watched by 3.1% of the total Croatian population and 7.5% of all active viewers at the time, which is an excellent result for any documentary programme at that peak time. Episodes 1 and 9 also stood out, with 2.6% and 2.7% of total population viewing, and 6.1% and 6.0% of all viewership captured, respectively. Episodes 7 and 8 attracted the smallest proportion of the total population, 1.2% and 1.3%, respectively, and they also attracted the smallest proportion of all viewers - 2.9% and 3.0%, respectively.

Total number of viewers that tuned into the episode at some point was, as a rule, about 50% greater than the average number of viewers who were actively viewing each episode throughout its course. The number of viewers tuning in at any point was the highest for Episode 5 (202.848), followed by Episode 3 (169.908) and Episode 1 (152.322), while Episode 7 (93.149) and Episode 8 (81.160) had the lowest reach. However, in terms of average viewership, Episode 5 (122.200) was followed by Episode 9 (104.604) and then Episode 1 (100.886).

The difference in rank of the episodes by their maximum number of viewers and their average number of viewers is best explained through differences that the episodes showed in average proportion of the episode viewed by each viewer. Some, such as Episode 2 (72.9%) and Episode 9 (70.6%) clearly had a very high

retention rate, while Episode 4 (48.4%) and Episode 7 (51.8%) didn't manage to retain their audience as well.

Six episodes managed to enter the top 15% of all daily programmes in the number of attracted viewers - Episodes 1 (12.6%), 2 (14.3%), 3 (13.4%), 5 (10.8%), 6 (14.7%) and 9 (14.9%). Episodes 4 (16.9%) and 10 (18.1%) made the top 20% of daily programmes, and Episodes 7 and 8 were around 25th percentile (25.7% and 24.4%, respectively).

Figure 1 shows the number of active viewers in each minute of each of the 10 episodes. It shows that Episode 3 surged from 60,000 viewers to 120,000 viewers over the first seven minutes of airing. Episode 1 also had a surge from about 85,000 to about 115,000 viewers over the first 6 minutes, Episode 6 from 90,000 to 105,000 viewers over the first 7 minutes, and Episode 10 from 90,000 to 105,000 viewers over the first 15 minutes. Solid performance in holding the viewership was noted for Episode 2 and 4. Episode 9 went from 105,000 to 125,000 viewers over the first 5 minutes, but then dropped viewers. Episodes 5, 7 and 8 were in an almost continuous decline.

Table 9 shows the number of viewers who were common to each possible pair of episodes. This analysis is remarkably useful because it shows the retention of the audience over the course of the entire series. It is particularly encouraging to notice that 56.552 of the viewers who watched the first episode have also watched the last 10th episode. Also, it is clear that there were new audiences joining each week, in tens of thousands, leading to a total cumulative viewership of over 1.4 million.

Table 8: Analytics on 10 episodes that were aired at Channel 1 of the Croatian Television between 19 Sep and 24 Oct 2018.

	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5	Episode 6	Episode 7	Episode 8	Episode 9	Episode 10
TV company airing the episode and channel	HTV 1	HTV 1	HTV 1	HTV 1	HTV 1	HTV 1	HTV 1	HTV 1	HTV 1	HTV 1
Date the episode was aired	19 Sep 2018	19 Sep 2018	26 Sep 2018	03 Oct 2018	10 Oct 2018	10 Oct 2018	17 Oct 2018	17 Oct 2018	24 Oct 2018	24 Oct 2018
Time the episode was aired	9:07 PM	9:16 PM	9:07 PM	9:03 PM	8:54 PM	9:10 PM	9:08 PM	9:17 PM	8:59 PM	9:08 PM
% total population watching the episode	2.6%	2.3%	2.4%	1.8%	3.1%	2.3%	1.2%	1.3%	2.7%	2.4%
% total population watching TV at the time	42.1%	42.6%	42.6%	43.2%	41.6%	41.3%	42.7%	42.5%	44.5%	45.1%
% of all active viewers watching the episode	6.1%	5.4%	5.6%	4.2%	7.5%	5.6%	2.9%	3.0%	6.0%	5.3%
Total number of viewers tuning into the episode	152.322	124.238	169.908	147.638	202.848	141.529	93.149	81.160	148.262	143.662
Average number of viewers of the episode	100.886	90.555	93.505	71.382	122.200	90.195	48.264	50.295	104.604	94.519
Average % of episode viewed by each viewer	66.2%	72.9%	55.0%	48.4%	60.2%	63.7%	51.8%	62.0%	70.6%	65.8%
Rank among all daily shows of any type	58/460	66/460	61/454	84/465	50/462	68/462	119/463	113/463	68/455	77/455
Rank as percentile among all viewers	12.6%	14.3%	13.4%	18.1%	10.8%	14.7%	25.7%	24.4%	14.9%	16.9%
Rank among all shows among 18-59 years	51/460	60/460	79/454	105/465	69/462	99/462	176/463	165/463	68/455	80/455
Rank as percentile among 18-59 years	11.1%	13.0%	17.4%	22.5%	14.9%	21.4%	38.0%	35.6%	14.9%	17.6%

Figure 1: Number of active viewers in each minute of each of the 10 episodes.

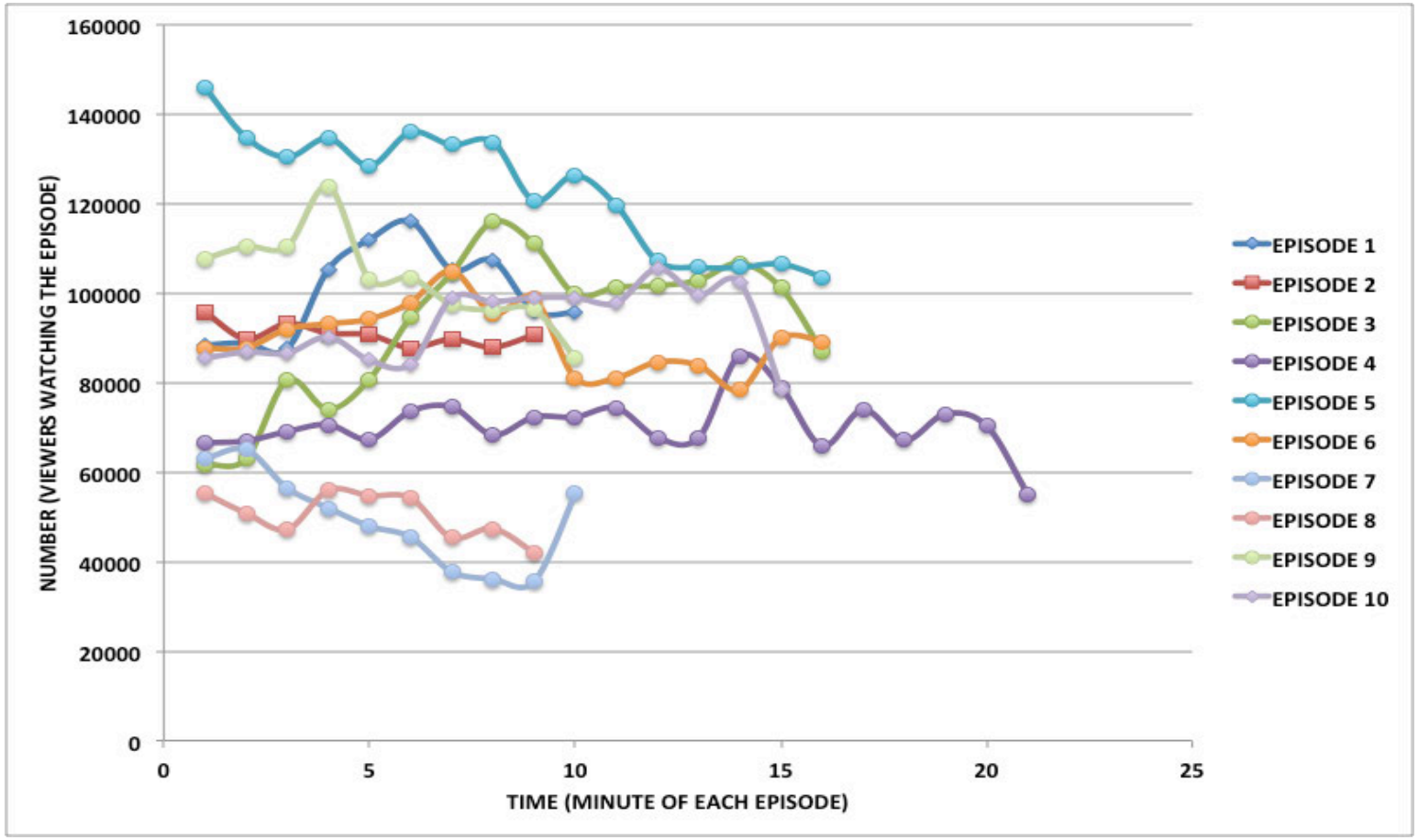


Table 9: Number of viewers who were common to each possible pair of episodes.

	EPISODE 1	EPISODE 2	EPISODE 3	EPISODE 4	EPISODE 5	EPISODE 6	EPISODE 7	EPISODE 8	EPISODE 9
EPISODE 2	97.399								
EPISODE 3	22.553	21.256							
EPISODE 4	46.491	39.380	26.336						
EPISODE 5	29.556	35.299	53.845	40.105					
EPISODE 6	28.631	30.923	30.516	33.576	96.774				
EPISODE 7	17.532	14.915	20.214	16.593	31.562	25.921			
EPISODE 8	19.373	13.404	21.567	17.681	22.152	22.315	51.020		
EPISODE 9	44.214	44.303	38.294	50.505	53.829	35.670	19.973	13.322	
EPISODE 10	56.552	51.823	30.128	57.454	40.163	32.522	21.973	19.531	98.586

Table 10: A detailed demographic analysis for the total reach of 1.404.706 cumulative viewers on the Croatian Television Channel 1.

Sett ement S ze	More than 5.000 nhab tants	53,32%
	Less than 5.000 nhab tants	46,68%
Reg on	Zagreb	39,38%
	North Croat a	16,92%
	S avon a	6,85%
	L ka Banov na	9,80%
	Hrvatsko Pr morje	11,64%
	Da mat a	15,40%
Income	Low	12,56%
	M dd e	52,62%
	Upper	28,51%
	H gher	6,30%
Sex	Ma es	39,24%
	Fema es	60,76%
Age'	4 9	2,75%
	10 14	2,24%
	15 19	0,85%
	20 24	0,77%
	25 29	0,67%
	30 34	2,64%
	35 39	6,02%
	40 44	5,75%
	45 49	7,33%
	50 54	5,29%
	55 59	9,59%
	60 64	13,87%
	65+	42,23%
Educat on Nat ona y we ghted	E ementary and no educat on	14,57%
	H gh schoo	42,24%
	Un vers ty and co ege	38,21%
Spec f c Age Groups	10 17	2,70%
	18 24	1,17%
	25 34	3,30%
	35 49	19,10%
TV sets	1 TV set	80,36%
	2+ TV sets	19,64%
L fe sty e	Unknown	7,51%
	Hard fe	10,17%
	Rout ne based	7,17%
	Fam y or ented	33,17%
	Loaded w th ob gat ons	8,54%
	Open m nded	15,74%
	Fun seekers	12,70%
Soc a C ass	Rura ower c ass (ret rement age househo ds)	9,14%
	Urban ower c ass (ret rement age househo ds)	15,06%
	Rura m dd e c ass (fam y type househo ds)	31,61%
	Urban ower m dd e c ass (b ue co ar househo ds)	18,37%
	Urban h gher m dd e c ass (wh te co ar househo ds)	25,81%

Table 10 shows a detailed demographic analysis for the total reach of 1.404.706 cumulative viewers on Croatian Television Channel 1. Interestingly, 47% of the audience were from towns smaller than 5,000 inhabitants, while nearly 40% were from the capital city of Zagreb. Around 27% of the audience were from the coastal regions of Croatia. About a third of the audience had upper or high income, more than a half were of middle income and 12.5% of low income. More than 60% of viewers were females. In terms of age, 5% were children 4-14 years, but there was a marked lack of interest in the age group between 15 and 35 years. Nearly 20% of viewers were between 35 and 50 years old, while about 30% were aged between 50 and 65 years and as many as 42% were older than 65 years.

Nearly 15% of the viewers only had elementary or no education, while 42% had only high school and 38% had University degree. Most of the viewers declared themselves as "family oriented" (33%) or "open minded" (16%). Most were rural middle class (32%), followed by urban higher or middle class (26%).

One important feature of the analysis of the TV data is that it differs substantially from the YouTube studies because the conditions were not controlled: the figures on viewership are based on a real-time information and they could have been influenced by competing programs which was not the case in previous studies. This is why we conducted a detailed analysis of the situation with viewership from 8.30 to 9.30 pm, when the episodes of “Survival: The Story of Global Health” were aired. We realised how many factors could have influenced overall rates of viewership. A few examples include: the weather outside and meteorological conditions which could have affected how many people decided to stay at home and watch TV, i.e. the absolute number of TV viewers in the first place. Then, UEFA Champions League football games could have been shown at the same time, and they are not only extremely popular but also feature a few Croatian players who play for well known teams, so this could have interfered with viewership. Furthermore, this time of the day was the “prime time” for TV viewership when daily peaks were being reached in all 6 weeks of airing

"Survival", so the competition between the channels was the most intense and some of the "reality TV" shows were being aired at this hour. Those were the most watched programmes in Croatia and the progress of the most popular contestants and the stage of each reality TV show could have drawn the audience away from the episodes.

With this in mind, we took a careful look at **figures 2-13**. Even numbers of the figures show the proportion of the total population watching each TV channel in Croatia on an exact date when the episodes of "Survival" were aired, while the figures with odd numbers reveal the proportion of all active viewers watching each TV channel in Croatia on the same date. In addition, Appendix 2 gives the exact details on the number of viewers for all TV programmes on all channels, allowing us to truly focus our analysis on the landscape of the programmes and the performance of various episodes of "Survival".

Figures 2 and 3 show that Croatian TV's channel 1 is watched by many in the early morning, when it reaches about 4% of Croatia's population and 50-60% of all active viewers. Its reach increases further around midday, when it reaches more than 6% of the population of Croatia, although by this time other programmes also start reaching their audiences. This is why the share in total viewership of Croatian TV programme 1 at 12.00 pm is just above 40% - still very high but this is in fact lower than between 6.00 and 9.00 am when its share is much higher, i.e. up to 60%, even though the absolute number of viewers is lower.

After midday, the reach of Croatian TV programme 1 (HRT1) drops below 2% of the total Croatian total population until the 2nd daily peak that of the News of the Day at 7.30 pm, when about 6% of the Croatian population are tuned into HRT1 again. But at this peak hour this now represent 25% of the viewership of all TV channels at this time of the day. From 8.00 pm to 11.00 pm the viewership then drops to slightly above 2% of the Croatian population, but at this peak time this only represents 5-10% of the viewers. Episodes 1 and 2 were aired between 9.07 and 9.25 pm. Therefore, they were seen by between 2-3% of total Croatian

population, but only 5-6% of the total viewership. At this time of the day, among the 10 most viewed channels available in Croatia, it outperformed 4 and it was less viewed than 5 others, meaning that it was the 6th most watched programme on Croatian TV.

We then inspected **Figures 4-13** to explore if this pattern persisted throughout all 6 weeks of airing "Survival", or if were there any substantial changes in particular weeks. Although the overall pattern seemed remarkably stable, in week 4 "Survival" was as high as the 4th most watched programme at the start of Episode 5, although it then dropped to 5th position towards the end. There was clearly some minor variation from week to week, but we can conclude that the overall pattern remained surprisingly stable.

Nuances in the differences from week to week are already captured in Table 8 and it is clear that Episodes 5 (in week 4) and 9 (in week 6) over-performed, while Episode 4 (in week 3) and Episodes 7 and 8 (in week 5) under-performed. We then turned to Appendix 2 to try to explore which other shows were competing for attention and if it was possible to provide a particular explanation for relatively high rates of episodes aired in weeks 4 and 6 with relatively low rates for those aired in weeks 3 and 5.

The strongest competition was from the two most popular shows by "Nova TV" "Na granici" ("On the border") a Croatian drama series watched by an average of 595,483 viewers in week 1, then 689,051 (week 2), 669,318 (week 3), 653,463 (week 4), 619,026 (week 5) and 594,681 (week 6). In addition, an adjacent reality TV show by the same TV company called "Farma" ("On the Farm") was watched by 443,897 (week 1), 504,593 (week 2), 476,048 (week 3), 568,138 (week 4), 534,933 (week 5) and 535,368 (week 6). Clearly, there was some variation between these programmes but the show "On the border" varied by within 95,000 viewers and "On the farm" by within 125,000 viewers.

Figure 2: Proportion of the total population watching each TV channel in Croatia on 19 Sep 2018 when Episodes 1 and 2 were aired.

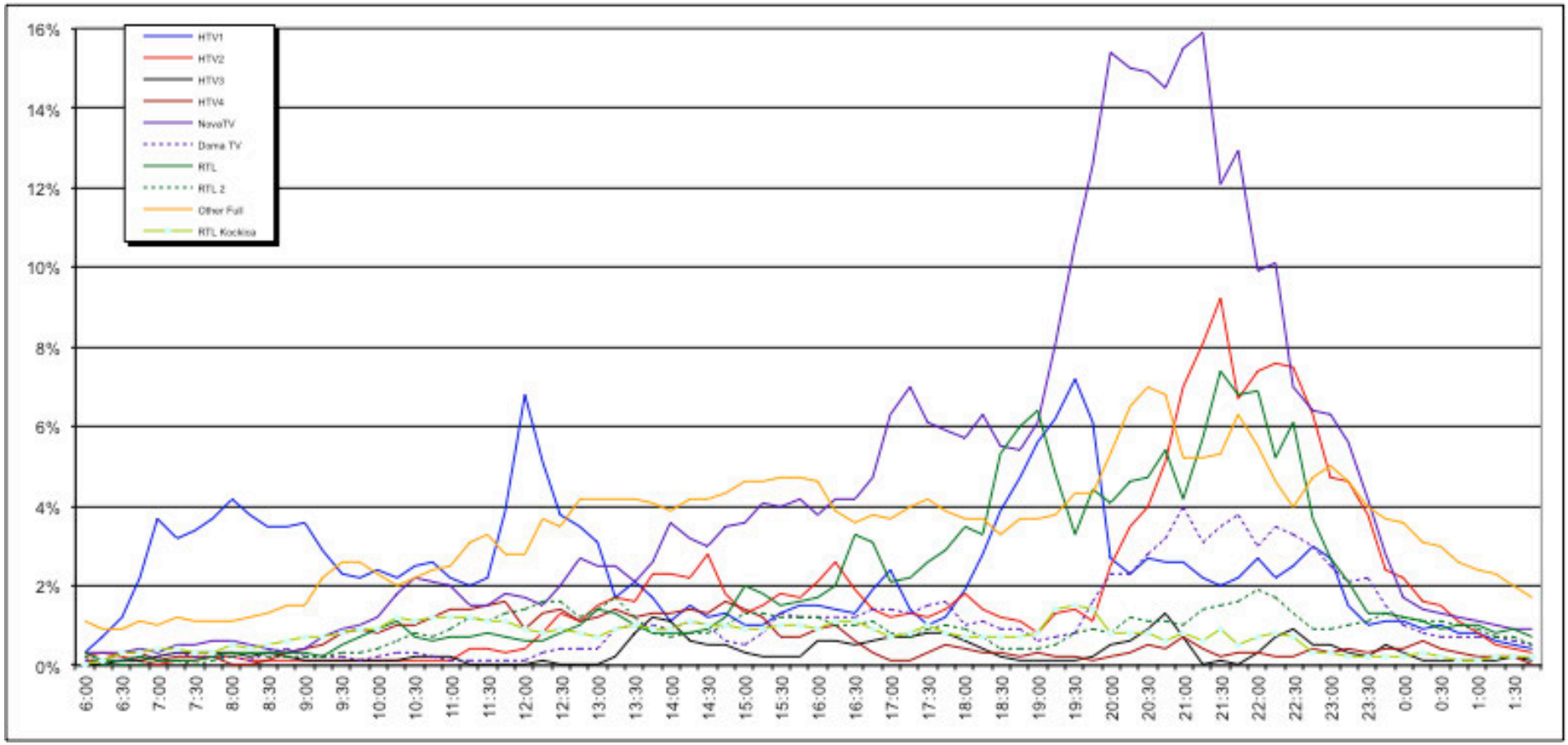


Figure 3: Proportion of all active viewers watching each TV channel in Croatia on 19 Sep 2018 when Episodes 1 and 2 were aired.

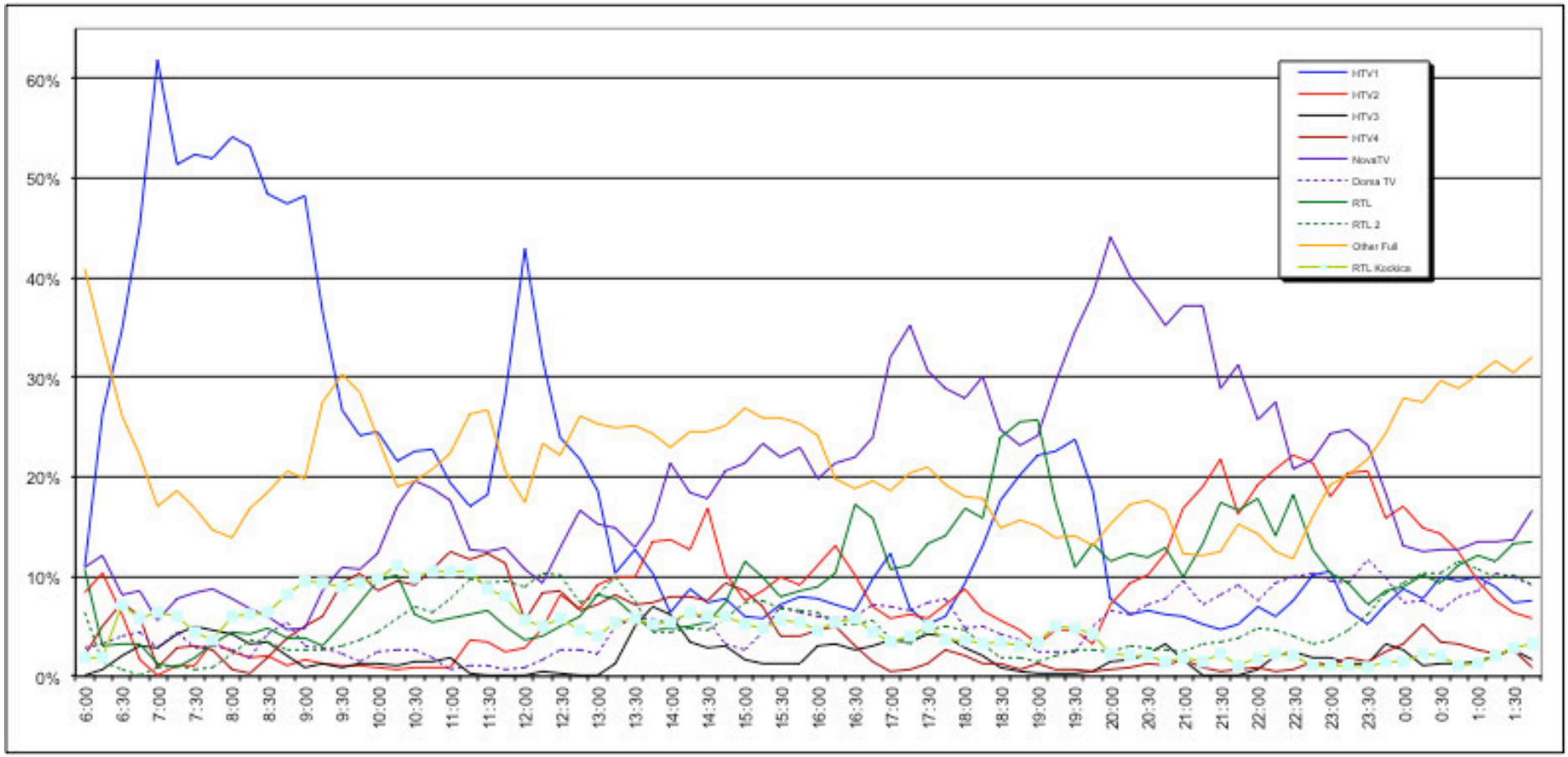


Figure 4: Proportion of the total population watching each TV channel in Croatia on 26 Sep 2018 when Episode 3 was aired.

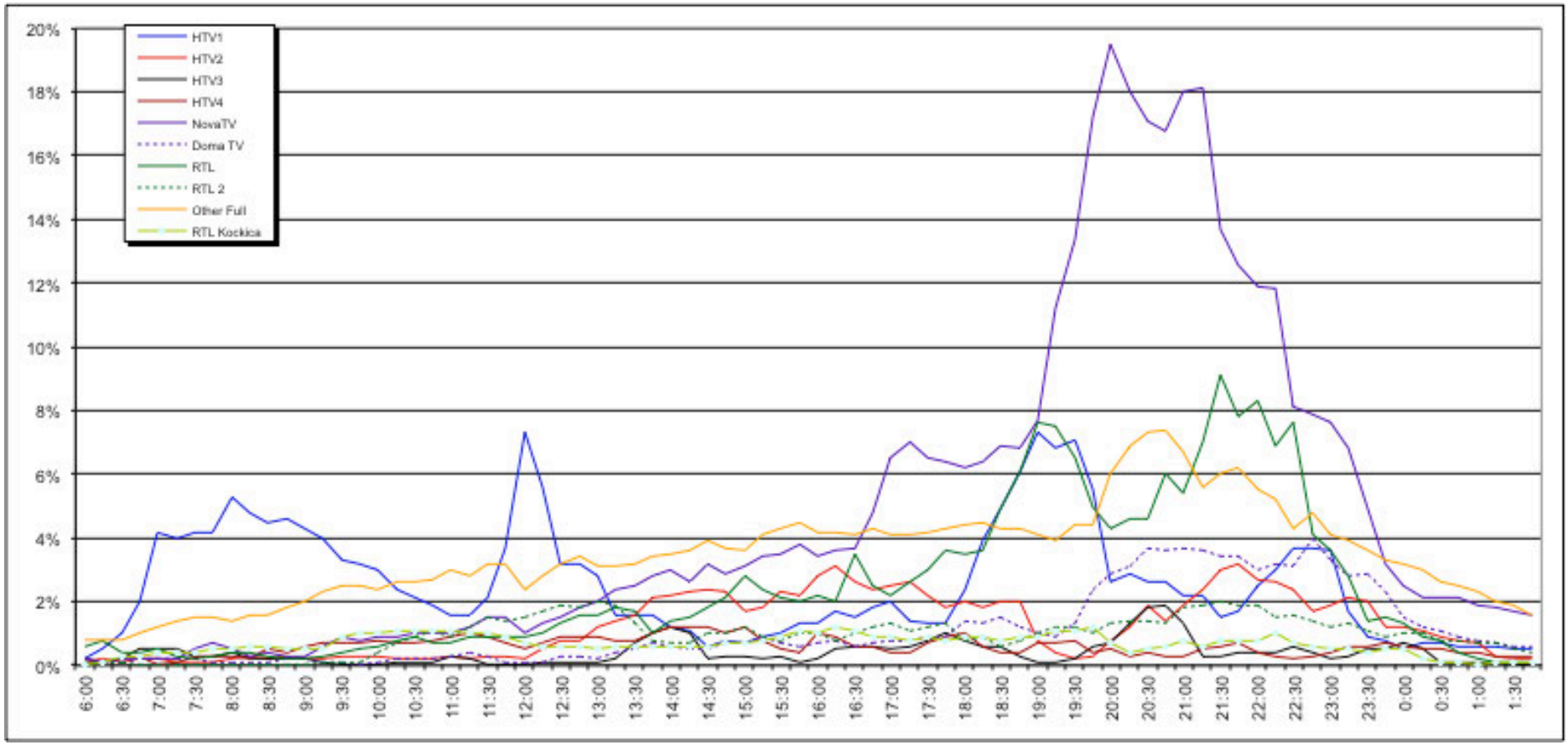


Figure 5: Proportion of all active viewers watching each TV channel in Croatia on 26 Sep 2018 when Episode 3 was aired.

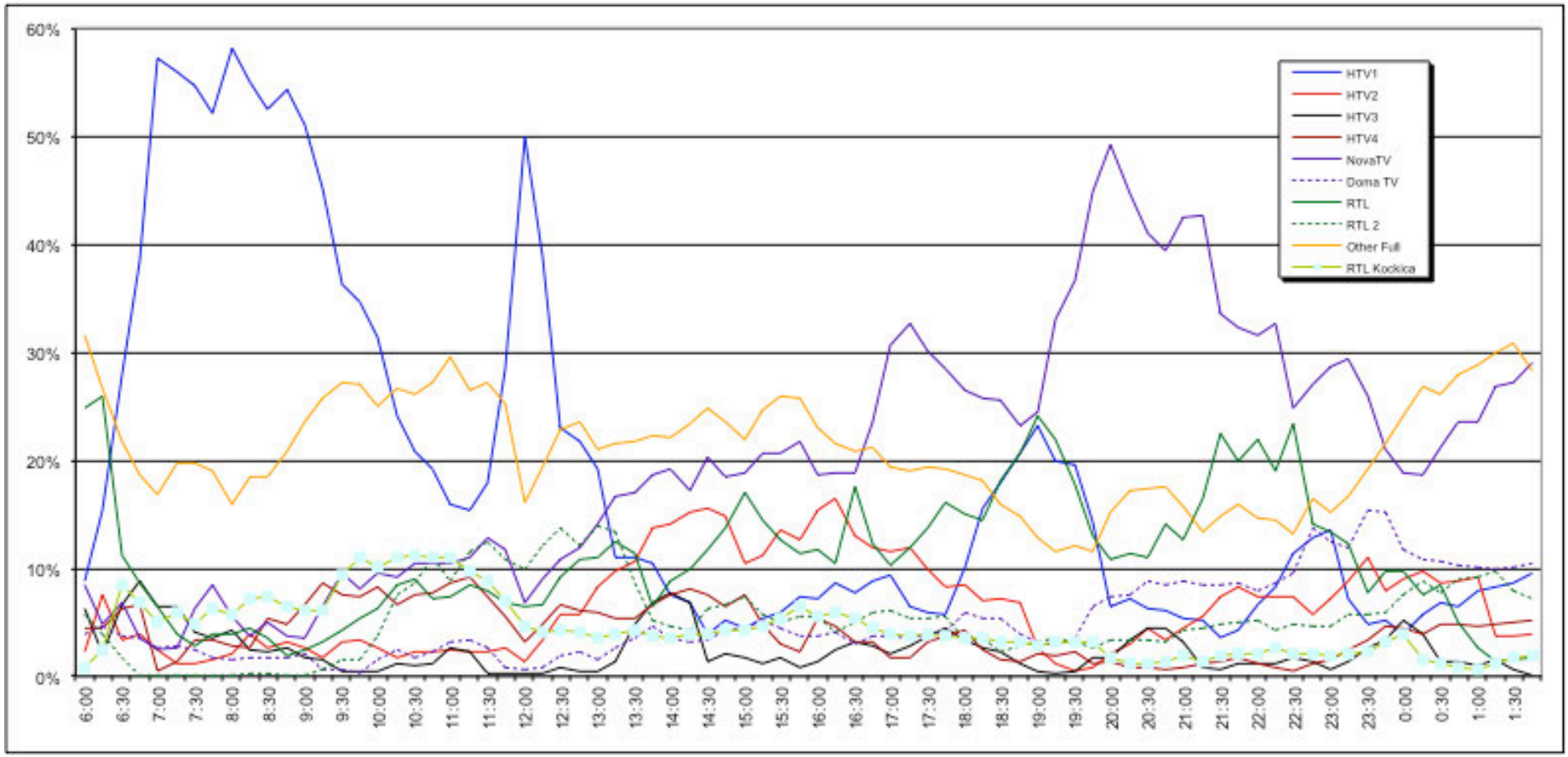


Figure 6: Proportion of the total population watching each TV channel in Croatia on 03 Oct 2018 when Episode 4 was aired.

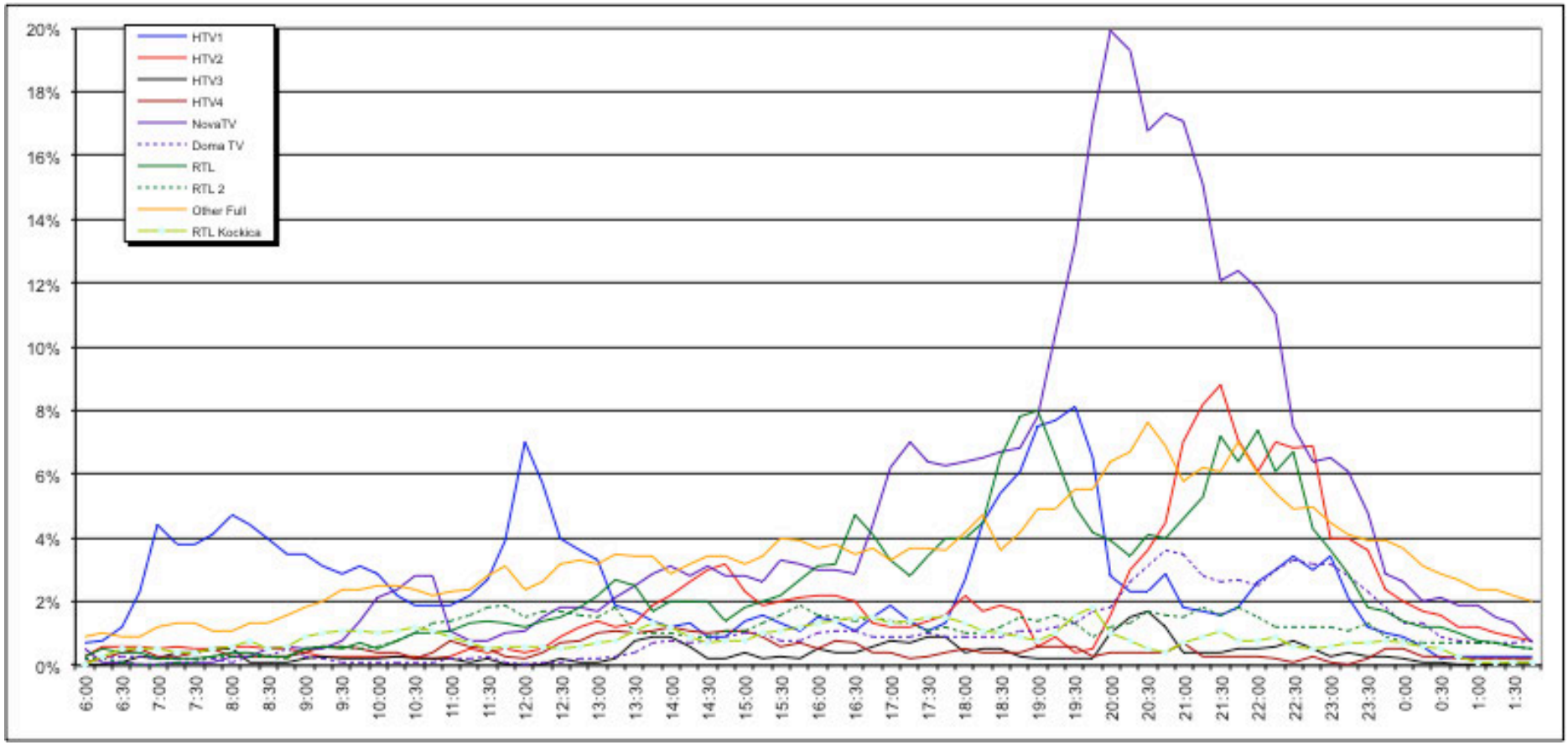


Figure 7: Proportion of all active viewers watching each TV channel in Croatia on 03 Oct 2018 when Episode 4 was aired.

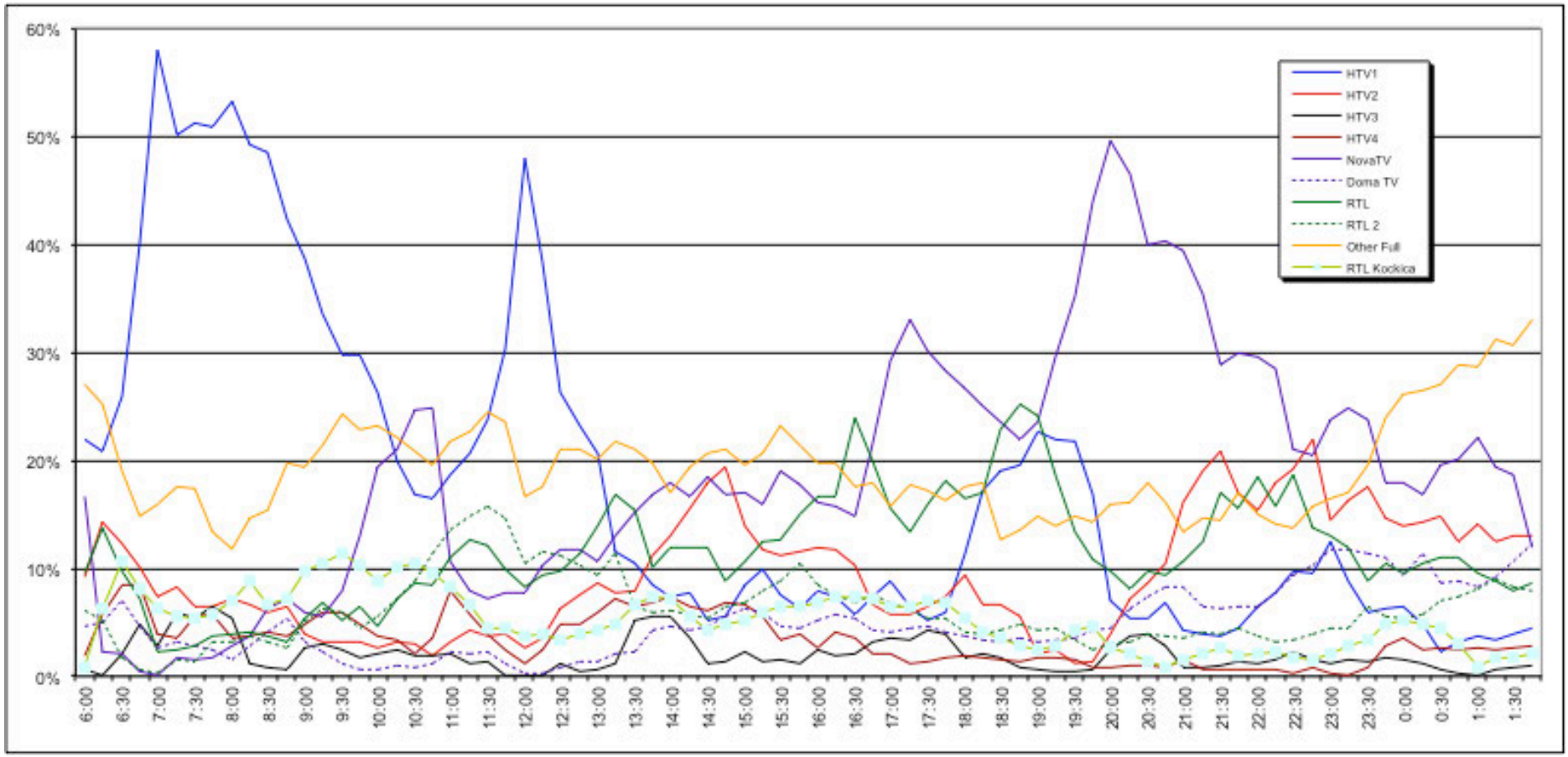


Figure 8: Proportion of the total population watching each TV channel in Croatia on 10 Oct 2018 when Episodes 5 and 6 were aired.

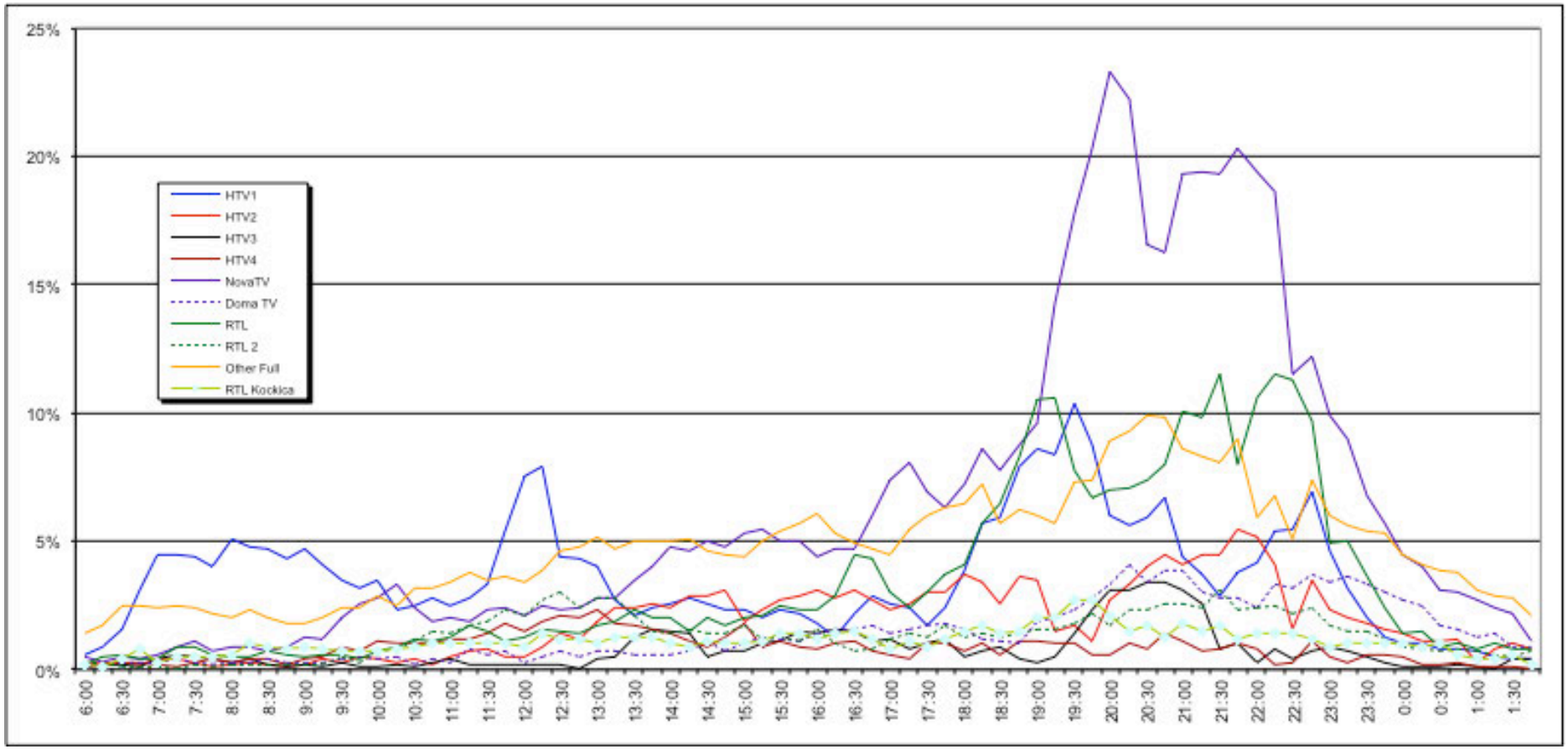


Figure 9: Proportion of all active viewers watching each TV channel in Croatia on 10 Oct 2018 when Episodes 5 and 6 were aired.

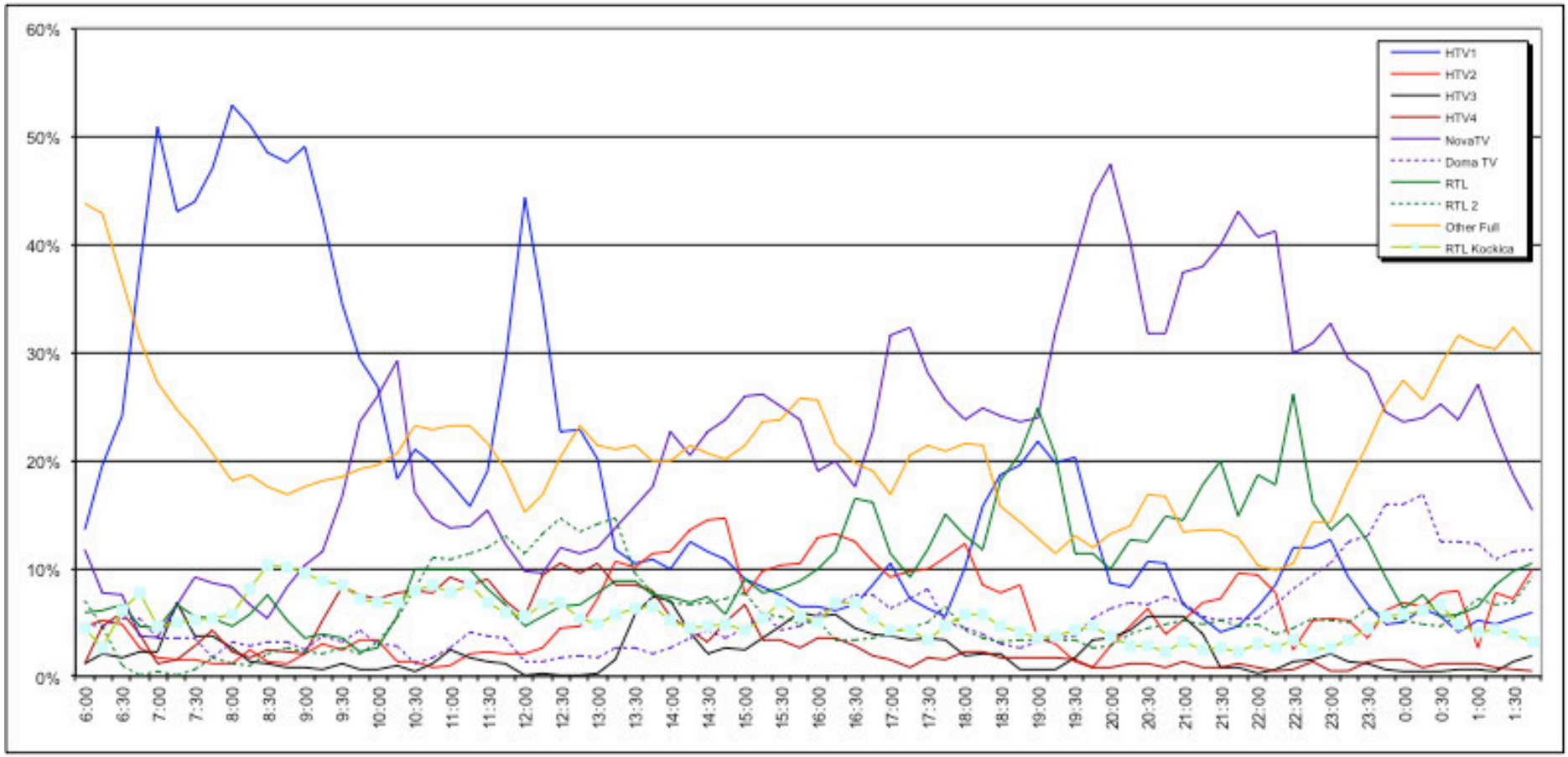


Figure 10: Proportion of the total population watching each TV channel in Croatia on 17 Oct 2018 when Episodes 7 and 8 were aired.

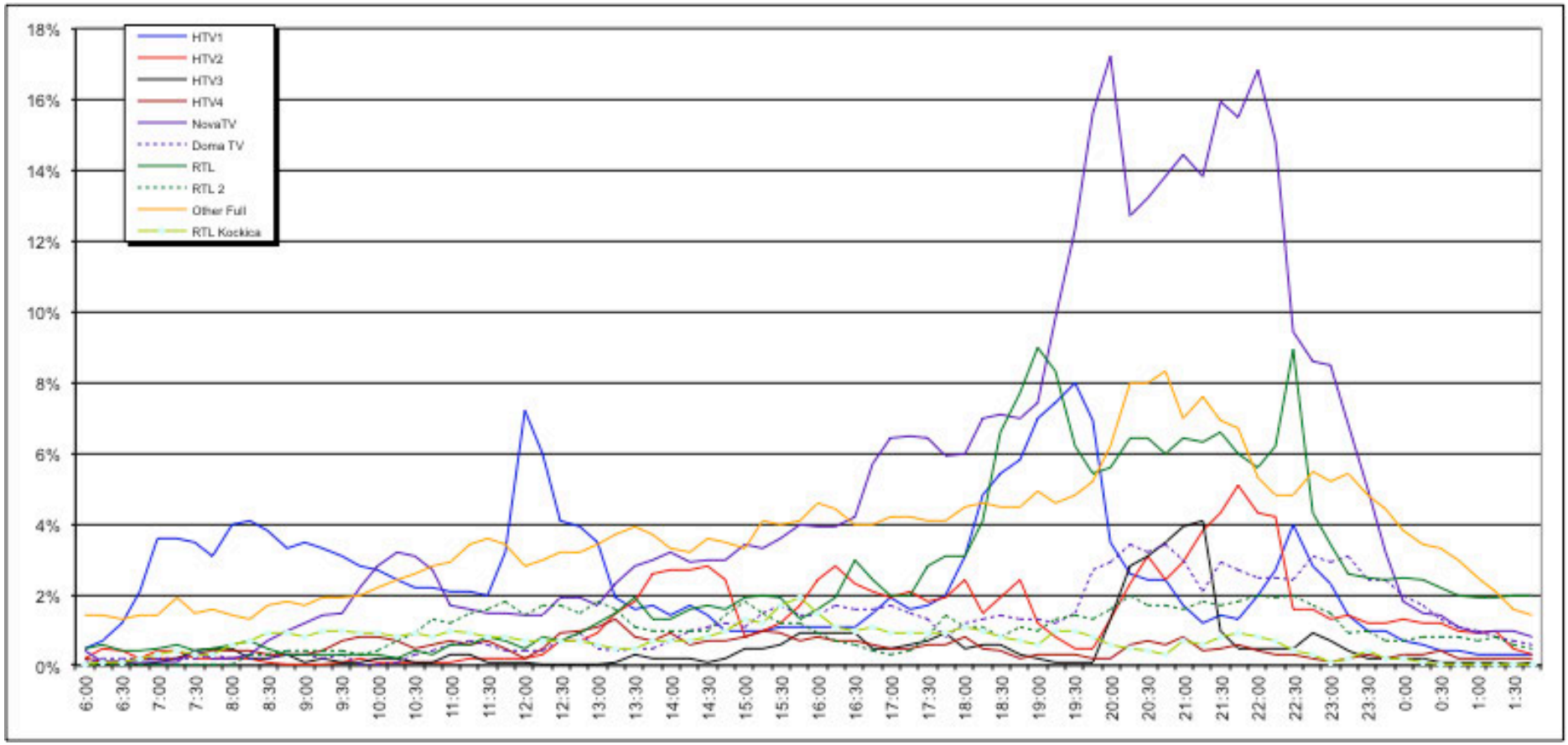


Figure 11: Proportion of all active viewers watching each TV channel in Croatia on 17 Oct 2018 when Episodes 7 and 8 were aired.

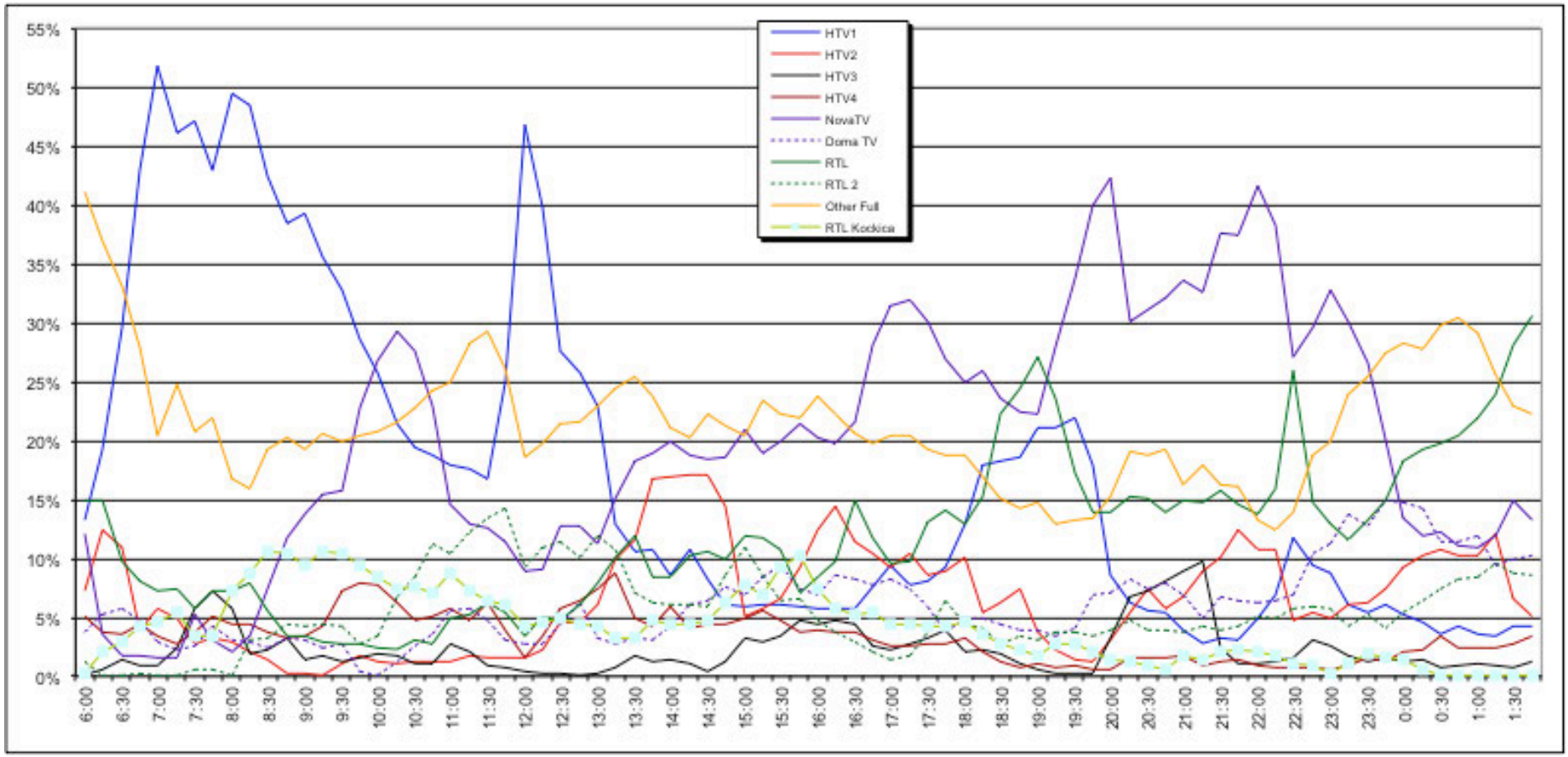


Figure 12: Proportion of the total population watching each TV channel in Croatia on 24 Oct 2018 when Episodes 9 and 10 were aired.

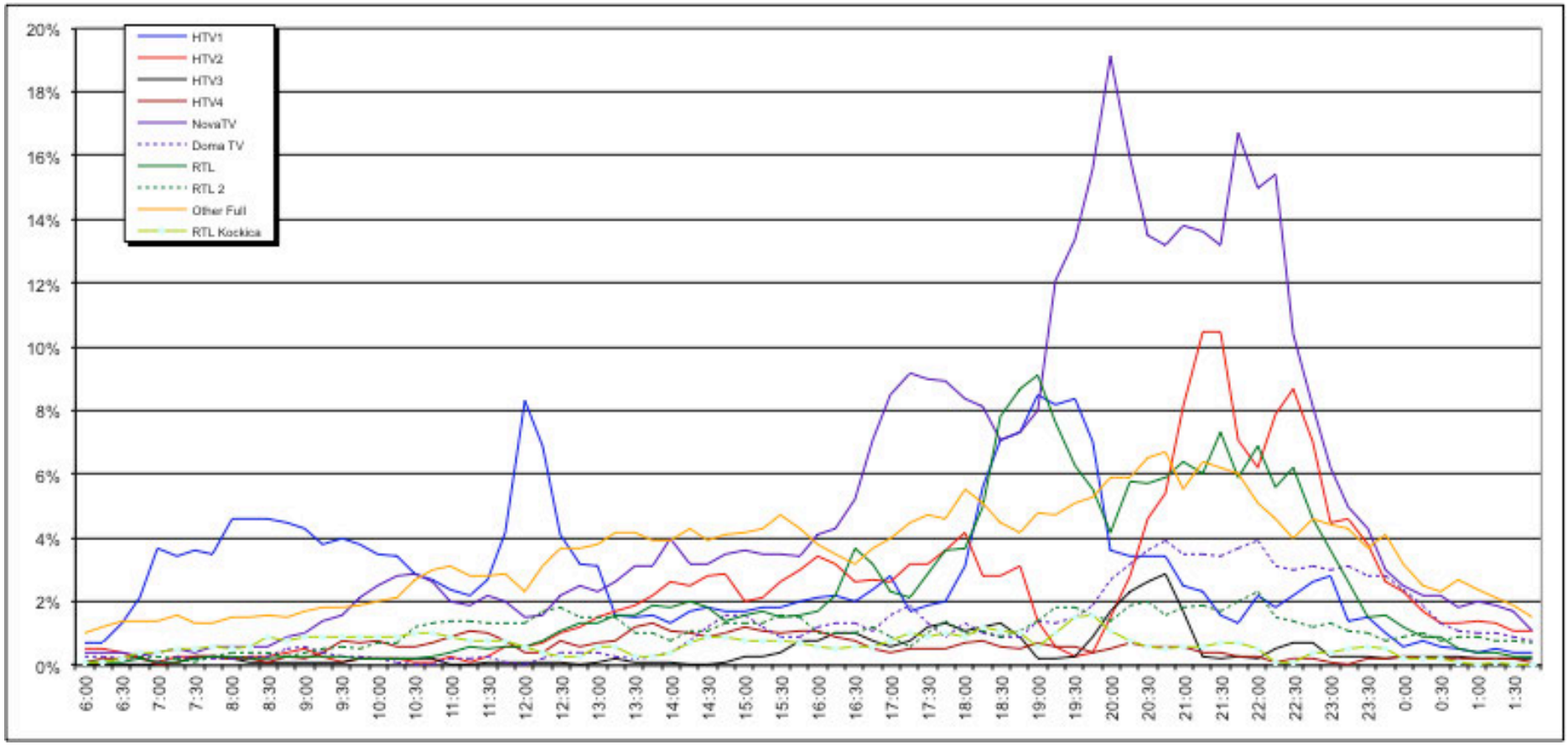
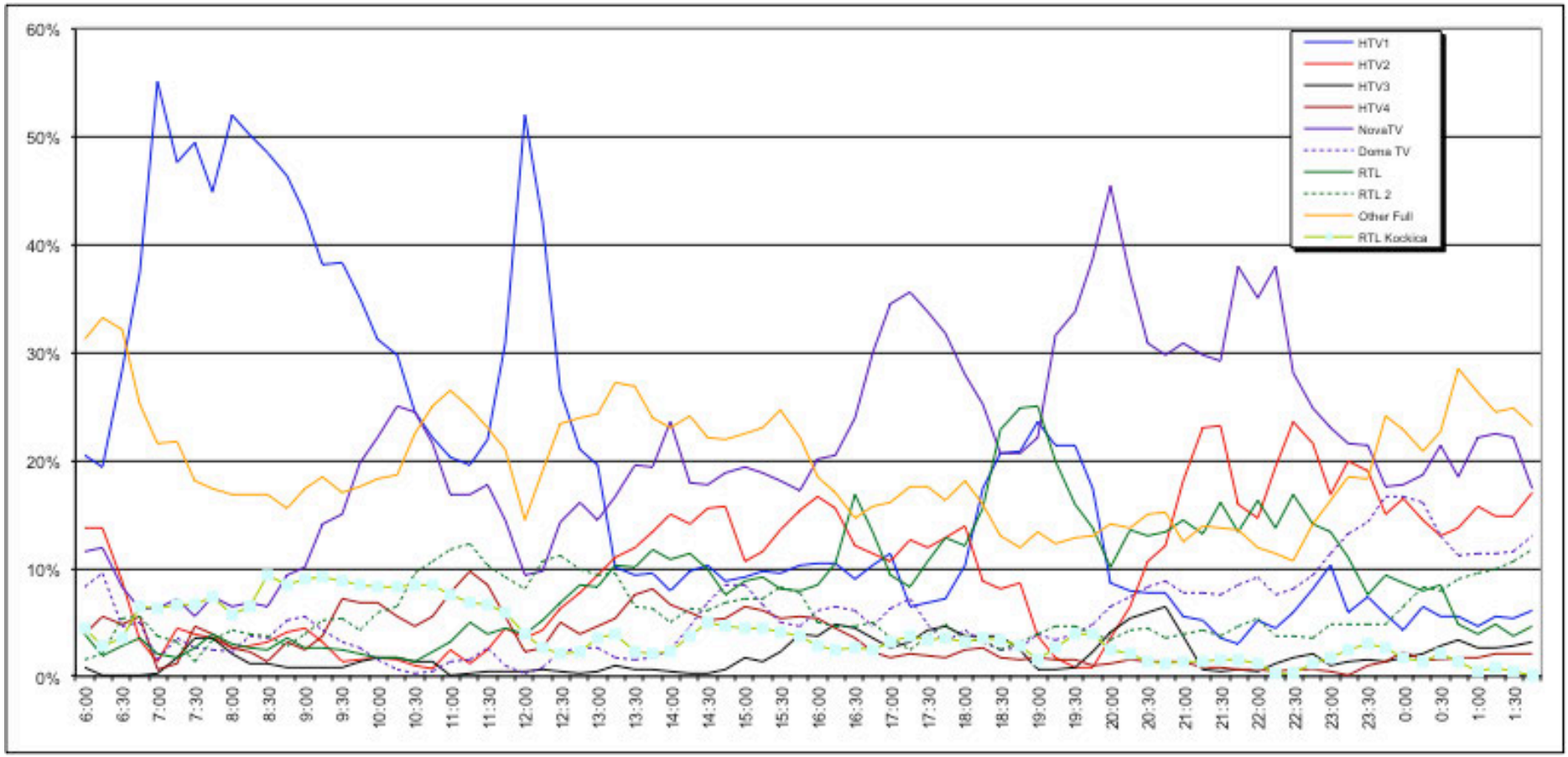


Figure 13: Proportion of all active viewers watching each TV channel in Croatia on 24 Oct 2018 when Episodes 9 and 10 were aired.



Another direct competitor was a reality programme by RTL television channel called “Zivot na vagi” (“Life on the scales”). In week 1 it was watched by an average of 240,381 viewers, and then by 299,874 (week 2), 248,170 (week 3), 275,240 (week 4), 241,960 (week 5) and 256,728 (week 6). It seemed to have a very stable viewership, ranging only within 60,000 viewers.

The third main competitor was Croatian National Television’s programme 2, but their shows varied depending on the UEFA Champions League football games. In week 1, they aired a Real Madrid-Roma game, watched by 321,735 viewers; then, in week 2, they showed a British-American thriller “Black sea” and only attracted 101,132 viewers; a week later, the Napoli-Liverpool game, watched by 317,534 viewers; then, in week 4, they aired a British action movie “Times of heroes”, which drew 120,482 viewers; in week 5, they aired another American thriller “Solace” which was seen by 154,594 viewers, and in week 6 there was football again a game between Barcelona and Inter was seen by 390,132 viewers. Clearly, there was massive variation between the viewership of the shows on HRT2, which varied by as many as 300,000 viewers.

Finally, the remaining competition came from the “Doma TV” television company, which was offering crime and drama series such as “Navy CIS”, “Seal Team”, “Mentalist” and “1st degree murder”. Their viewership ranged throughout the 6 week period between 88,000 and 137,000 viewers, varying by up to 50,000 viewers in each week.

Based on this information, it is easier to understand how well “Survival: The Story of Global Health” actually did in this fierce competition that was carefully targeted to the preferences of the Croatian general population. Some of its episodes had better ratings than drama series shown on “Doma TV” and American and British thrillers shown on “HRT2”. In fact, the most watched episodes managed to reach about a third of the viewership of Champions League games, which is quite remarkable. The drop in week 3 may have occurred partially due to football, but the drop in week 5 did not in fact, this makes the

results of Episode 9 and 10 in week 6 all the more remarkable, as it was achieved in competition with the Barcelona-Inter game which drew a large audience. The same applies to Episodes 1 and 2 which also did very well in competition with football. It seems that there simply wasn't much interest in the "core" global health topics shown in Episodes 7 and 8 to get the viewership sufficiently interested in the first place. Another factor that likely affected a poorer-than expected result for Episode 4 was that it was already well known to viewers through social networks and online news portals. However, the results by Episodes 1, 2, 3, 5, 6, 9 and 10 were all very encouraging indeed.

4.4 Average View Duration Between Studies

Comparison of metrics across the different studies is quite difficult since metrics with the same names across the platforms represent different qualities of engagement with the material. For example Facebook auto-plays Facebook embedded videos as the user scrolls through their newsfeed. If a user allows the video to play for more than 3 seconds (even when scrolling to look for other content) then this is counted as a view. YouTube will only count a view after 30 seconds of watching [166]. YouTube does have an autoplay feature however this is not equivalent to the Facebook news feed where content is indiscriminately scrolled past thereby accumulating views. Therefore, a view on YouTube represents a different level of engagement than a view on Facebook because of the different ways in which they are measured.

Similarly, comparisons with national television are even more difficult as a "viewer" on television represents something quite different from either of these "view" metrics. YouTube and Facebook count multiple views from the same person as new views whereas multiple views from one person on national television are counted as one new viewer. National television channels have large audiences and viewers will change between channels to find something they want to watch. This means that content is competing with other national television channels for attention and so many conflicting factors such as popular sports games of popular shows will affect the viewer numbers.

Taking these limitations into account there is still the opportunity to compare the average view duration between the studies as this metric indicates the same quality of engagement regardless of the promotion methods or presentation platform.

The Average View Duration (AVD) can be compared between Facebook organic promotion, YouTube advertising and television broadcast. Regardless of the promotion method the AVD reflects how long on average the viewer remained engaged with the content. The national television study measured the average % of the episode viewed by each viewer which has been converted into the equivalent AVD according to the length of the episode for this analysis.

Table 11

	Avg. View Duration on YouTube (Video posted on Facebook only)	Avg. View Duration on YouTube (Advertised on YouTube only)	Difference in Avg. View Duration
Episode 1	2:58	3:14	0:16
Episode 2	2:54	3:28	0:34
Episode 3	3:54	4:55	1:01
Episode 4	4:44	6:00	1:16
Episode 5	2:38	4:37	1:59
Episode 6	4:48	5:15	0:27
Episode 7	2:41	3:27	1:46
Episode 8	2:47	3:41	0:54
Episode 9	3:12	3:58	0:46
Episode 10	4:02	4:45	0:43

This table compares organic promotion on Facebook vs advertised promotion on YouTube of the YouTube videos. The highest AVDs occurred for Episode 6 and

Episode 4 when posted to Facebook and the lowest for Episodes 5 and 7. YouTube advertising also resulted in the highest AVDs for Episode 4 and Episode 6 and the lowest for Episode 1 and Episode 7. The similarly high AVDs across both methods of video promotion for Episodes 6 and Episode 4 indicate there are some inherent features of the video making them more engaging independently of how they were promoted. An inherently higher engagement value of episode 4 content is certainly supported by results from across the studies. It is clearly indicated by the higher number of shares and high exposure through national media unique to this episode. This increased interest and engagement was clearly due to the narrator's Croatian following and their increased interest in vaccination during the Croatian measles outbreak. However the advertised YouTube video content was shown indiscriminately to audiences around the world with no targeting of any kind applied and yet it still received the second highest AVD of all of the episodes. This finding along with the similar lack of engagement with episode 7 when advertised gives some indication that the Croatian public's response to the topics may reflect wider global engagement with the videos.

The low AVDs for Episode 7 seem to indicate a particular lack of engagement with this video independently of how it was promoted. Interestingly the initial enthusiasm for Episode 1 (due to being the first in the series) reflected across the studies is not reflected to the same degree in the AVD data when the video is advertised. This is likely to be because the YouTube advertising did not show the videos in any kind of sequential order as the Facebook postings did and so additional enthusiasm around the start of the series would not be expected to be observed.

Table 12

	Avg. View Duration on YouTube (Video posted on Facebook only)	Avg. View Duration on YouTube (Advertised on YouTube only)	Avg. View Duration (National Television Broadcast)
Episode 1	2:58	3:14	6:04
Episode 2	2:54	3:28	5:48
Episode 3	3:54	4:55	8:27
Episode 4	4:44	6:00	9:35
Episode 5	2:38	4:37	8:54
Episode 6	4:48	5:15	9:54
Episode 7	2:41	3:27	4:29
Episode 8	2:47	3:41	5:29
Episode 9	3:12	3:58	6:29
Episode 10	4:02	4:45	8:51

Analysis of the national television broadcast data further confirms the high engagement with episodes 4 and 6 and low engagement with episode 7 independently of how they are presented. Episodes 4 and 6 received the highest AVD on television and Episode 7 received the lowest AVD. The television channel broadcast the episodes sequentially and it is likely that this is why episode 1 received quite a high average view duration view in this study compared with the advertised episode 1. This dynamic between sequential and random presentation of the episodes indicates the importance of a highly engaging first episode to make the most of the high initial viewership and to retain the audience for future episodes.

It is also interesting to note that the highest average view durations for all episodes occurred on television with episodes 1, 3 , 5, 9 and 10 having more than double the AVD of the same episodes posted on Facebook. Since the higher AVD occurs across all of the episodes this may indicate a higher level of engagement with television in general as a more involved medium. Social media browsing can

be quite superficial and does not require much concentrated attention whereas sitting down to watch a television broadcast may require a higher level of commitment to the activity. This is an interesting observation as it indicates that despite the ease of access to social media promotion there may still be higher value placed by the public on television content.

Comparing advertisement to natural promotion on social media, one might expect that the narrator posting the videos to his own Facebook page with an audience interested in the topics would result in higher view durations. However, for every video in the series the viewers who reached the content through advertisement viewed for longer on average. The AVD averaged across all ten videos is 3:44 for those posted on Facebook and 4:32 for those advertised on YouTube. While the higher AVDs on television are quite easy to understand this finding is less intuitive. It may be the case that the YouTube videos promoted through Facebook diverted those already on Facebook from their browsing and therefore resulted in lower AVDs. Whereas the YouTube advertising reached people already on YouTube seeking to watch video content and therefore had higher AVDs.

Chapter 5:
Discussion

To contextualise this study and understand its generalizability, I should firstly stress that it was conducted initially among the 800 Croatian Facebook followers of the narrator of the videos (IR). At the time, the narrator was already a well-known researcher and a leading public intellectual in Croatia, so it was expected that his sharing of the videos will receive some attention. Moreover, his followers were mostly highly educated persons, i.e. a more receptive audience for documentary content than the general population. It is reasonable to assume that those two factors assisted the initial uptake and spread of the videos in the online space. All 10 videos were shared at the same time of the day, accompanied by a brief text describing their content, to ensure that those two factors did not affect the uptake and initial interest. Based on these considerations, I observed a wide variation of the degree of interest from followers and in some cases interest extending well beyond his core following to the general public.

Secondly some background information on how YouTube advertising works will be beneficial in understanding my results. Youtube advertising works on the basis of showing a large number of low-cost adverts to targeted audiences and achieving a response from small percentages. The percentage of people watching beyond ten seconds of the video is generally quite small (around 27.7% on average) even in the case of targeted commercial content. However the low cost per view ($0.044 on average) allows the adverts to be shown thousands of times without incurring large costs [147]. Click-through rates are generally even smaller since the advert is interrupting video content the user intended to watch. With precise audience targeting these numbers can be increased and by showing the ads at scale large audiences can be reached.

While the first study was entirely unaffected by any form of advertising, the second study launched untargeted video adverts. This design aimed to attribute improvements in any given metric mostly to the content of the video. This approach allowed us to reach a general audience who would not be biased for or against watching global health content.

5.1 Responsive Content: Contribution to Public Conversations and Debates

The documentary series received a remarkable response from the Croatian public and became one of the most popular shows on national television at the time. The first study showed Episode 4 on pandemics and epidemics to be a clear outlier in popularity with 9,784 views. It was quite easy to discern the reason for this result as the episode triggered a large public debate in Croatia which at the time was experiencing a measles outbreak [148]. Many of the large Croatian news broadcasters, online newspapers and public figures began to share the video and a significant public debate was triggered. Since the measles outbreak was an issue of concern in Croatia at the time, the video's addressing of the wider historical issue of pandemics served to focus the public debate towards the value of vaccination. As a result of this reaction to the video the narrator (IR) was invited to give several interviews in the Croatian media. The full "Survival: The Story of Global Health" documentary series was then shown as a primetime show on Croatian National Television's Channel 1 and reached a viewership of around 1.2 million over the course of the series.

During the national television broadcast Episode 5 had the highest level of viewership of any episode and I attribute this to the rekindling of media attention around the issue of vaccination and measles after Episode 4 aired. Since Episode 4 was watched widely online and was shared virally but received a relatively small audience when broadcast on television, this is likely to be because most of the audience had already seen it. After media attention refocused on the vaccination debate Episode 5 viewership soared to over 140,000 viewers and remained at a higher viewership than all other episodes for most of its duration. It addressed non-communicable diseases and so it provided a continuation of theme from communicable diseases covered in Episode 4.

Global health research is for the most part focused on long-term development goals and so global health media content does not always feature prominently

in the transient day-to-day media. However, there have been several examples of the global health community successfully using the media attention generated by extreme events, such as pandemics, to drive changes in public opinion, infrastructure and policy reform. The success of Episode 4 highlights the importance of releasing relevant media content at such critical points of a public concern and an ongoing debate.

The commercial advertising industry is familiar with the value of such approach to engage with the public. As the pace of social media sharing accelerates, many marketing agencies have developed a form of reactive marketing that is sometimes referred to as “Piggyback Marketing” [149]. This term refers to marketing which redirects attention from existing traffic sources such as popular news stories, events or debates in the media. In this case the measles epidemic was already a popular story in the Croatian media and our video served to refocus the public debate towards real science and long-term sustainable solutions. Much of the online debate at the time had focused on perceived short-term dangers of vaccination which were not based on scientific evidence. Our video provided a wider scientific and historical overview of the devastating impact of pandemics and therefore indirectly promoted the use of vaccines.

It is interesting to note that while this episode was the most popular in terms of views and the 2nd most popular in terms of likes, it also received a number of negative comments in the "comments" sections of online newspapers [150], as well as the highest number of dislikes on YouTube - albeit only three in total. Controversial issues that generate strong views on either side of the debate may be areas where greater impact on public opinion can be achieved. In the debate on vaccination we made a positive impact by simply presenting unbiased scientific and historical information in an appealing video format that was simple to follow.

It can be seen from a brief reading of the comments posted about the video online (see Table 3) that the majority of the anti-vaccine comments stem from

a conspiratorial suspicion of the motives of those in authority. Both sides claim that scientific evidence supports their position. On the anti-vaccine side there were more reports of personal experience informing their opinion on vaccines, for example “"I stepped on a rusty nail a few times, but I never took a tetanus vaccine and I never developed tetanus". Episode 4 tackled these objections on two levels, the first was to place people’s personal views and experiences within the broader context of history. Showing the devastating impact of pandemics throughout history and how vaccination now prevents similar outcomes allowed people to examine their individual experience in a greater context. Secondly the video provided a voice of authority with scientific credibility to the debate describing the facts about vaccination. Unfortunately many still perceived the narrator to be complicit in a great conspiracy in his promotion of this message as can be seen in the comments.

The episode clearly benefited from linking global health messages to an ongoing public debate. It may be the case as with commercial marketing strategy- that global health messages could be linked to other ongoing debates in the media which are drawing large audiences.. This would, clearly, require quite a lot of creativity, but there are many examples of charities and commercial marketing campaigns achieving success with this approach.

5.2 Creating a Strong Media Identity

In the current media-scape with its many strong and opinionated voices the global health community can benefit from producing authentic public figures with a strong identity who contribute to national debate. The focus on science, long-term infrastructure development and policy in the global health community should make it an influential voice of reason and clarity in a media space dominated by “fake news” and spread of inaccurate information.

In the first study, the view count was greatly helped by the already growing public profile of the narrator (IR), who presented the series, as the "public intellectual" in Croatian media space. The news that the narrator was launching a

new video series generated a high number of views on video 1 (10761), but this dropped to 3117 and 2793 on episodes 2 and 3, respectively. The large surge in viewership in Episode 4 after the drop-off indicates that the popularity of Episode 4 cannot be solely attributed to the narrator's public profile, but rather the content of the video. The combination of a "well known public intellectual" figure with a timely contribution to impassioned public debate seems to be an effective combination to achieve viral spread.

"Celebrity" status can clearly bring attention to global health subjects. However, Markham [151] provides evidence that members of the public who are interested in "celebrity culture" are not necessarily the most likely to participate in supporting important social issues. For this reason we believe that some of the most effective "celebrity figures" to promote global health topics will not be "traditional celebrities" - who may be famous for a variety of interesting reasons - but rather scientists and researchers who step into the public space. A clear example of this was the late Dr Hans Rosling, who brought authenticity to the public debate and had the authority of a scientist and a professional researcher. We believe this was a key feature of the narrator's appeal to the Croatian public, given that he is well recognised in the Croatian media as one of the few leading international scientists of Croatian origin [152].

Throughout the series we defined a strong humanitarian identity for the voice of global health in the Croatian media by ensuring that every episode communicated some core values of the global health community:

1. Scientific research.
2. Learning from history.
3. Equality and Equity.
4. Embracing technology and progress to improve quality of life.

We viewed each engagement through the media as an opportunity to advance and strengthen the identity of the unique voice global health has to contribute.

5.3 Narrative Formats: Speaking the Language of the Audience

One of the most striking findings from the television data is that the two most explicitly global health orientated episodes (7 and 8) which used the most global health terminology had the least viewership. For each of these episodes the viewers dropped off quite dramatically as the episode went on when watched on TV. On Youtube they received the lowest and 3rd lowest average view durations for all episodes (2.41 and 2.47). The primary difference between these two episodes and the others is that they focused on global health organisations, charities, NGOs and development goals instead of stories and dramatic tales from history. Episode 8 on sustainable development goals (episode 8) contained some of the most valuable information in the series on the future of global health development and yet received very little attention from the audience with only 81,000 viewers. The viewership then soared back up to 148,000 for episode 9 which turned the focus back onto issues of public concern such as economic inequality. This response made it quite clear that the field of global health itself was not of great interest to the audience and describing its inner workings and challenges was not an effective strategy in gaining their attention. It is interesting to note that episode 3 began with a very similar initial viewership to episodes 7 and 8 but rapidly gained instead of losing viewers with its fast-paced dramatic presentation of the history of communicable diseases.

The episodes which featured narrative based and historical content were far more popular than those which dealt with the technicalities of global health. It seems that the long-term goals of the global health community may be best received by the public when presented in a narrative format based on the stories of those directly affected by the issues.

The major motivations driving the public's use of social media are entertainment, social interaction and information seeking. [153] In this respect I misjudged the communication of our message in these episodes. Global health messages clearly cannot be shoe-horned into the public's social media feed but must instead contribute to their experience on the platform by entertaining

them, providing valuable information or helping them connect with their friends. We provided information in these episodes but the focus was on global health internal politics and organisations which were of little interest to the audience. If we were to remake these episodes we would turn our attention back to towards entertainment and a focus on how these various issues are of relevance to the public.

5.4 Negative and Positive Emotional Valence

Considering that entertainment value is an important factor in engaging audiences it is perhaps unsurprising that in both studies episode 6 "Ageing and Dying" which covers some grave subject matter generated very low engagement from the audience. In the first study it received the smallest number of views (1,110). In the second study it received the lowest view rate (13.83%) and the second lowest number of clicks. The view rate shows how many people kept watching after 10 seconds, which is approximately the time that the title of the episode remains on screen. The low number of views and high drop-off rate after viewing the title screen may imply a reaction to the negative emotional valency of the episode title in comparison to the aspirational/positive titles of many of the other episodes. "Episode 6: Are Ageing and Dying Inevitable?" may have been a hard-sell for people casually looking for entertainment on YouTube. This observation is in line with positive marketing philosophy as delineated by Berger [154] who noted that content which produces positive emotions is more likely to become viral than negative content.

However, it should also be noted that this episode received the highest likes-per-view ratio in the first study and the second highest view duration in the second study. It also received the highest average view duration through both Facebook promotion and Television broadcast. This indicates that those who did decide to watch the episode were highly engaged with it. This is a very interesting result as it shows that the number of views which is currently a primary engagement metric in scientific studies does not necessarily correlate

to deeper engagement with the material. Deeper engagement metrics such as average view duration help to tease out these insights. Berger notes that negative sentiment content can still be highly engaging if it leads to high negative emotional arousal. Clearly news reports on terrible circumstances can still engage audiences even if they would prefer not to be hearing such news.

The serious and sometimes tragic subject matters that global health researchers need to convey to the public are far more difficult to communicate on a popular level than many other fields of research. When the goal is to raise public awareness of such issues, it may be beneficial in some cases to present these topics with different kind of emotional stance. The increasing recognition that the public have become fatigued by negative charity advertising was catalysed by research from Seu and the London School of Economics [155]. They found that public perception of international aid agencies has become increasingly negative due to resentment of "excessively traumatic campaigns". While negative messaging can drive short-term donations and support, there are indications that this is not a sustainable strategy. The implication is that charities need to build long-term relationships with supporters based on positive emotional experience. Referring to such short term negative advertising strategies, co-founder of "Regarding Humanity", Linda Raftree, said: "We know that organisations need to raise funds for their work, but when it comes to such advertising and campaign imagery, they're often acting detrimentally to their long-term goals" [156]. An excellent creative example of a successful campaign focusing on a positive approach to difficult issues is the Sick Kids Foundation advertising which presents sick children and doctors as super-heroes fighting against illness and disease [157].

The audience's reaction to our videos seemed to indicate that they have particularly high threshold for content which:

1. Could engender negative emotion.
2. Is not of direct relevance to them.

Such content fails to appeal to the main motivations for using social media: entertainment, information seeking and social interaction. Such an audience reaction is actually quite intuitive if global health researchers were to consider themselves guests at a real social event trying to convey their message. One would not immediately present traumatic content or stories to a person they are meeting before knowing them reasonably well. People seem to appreciate many small positive interactions before moving to deeper topics of conversation and perhaps this effect is true of social media feeds also.

Since the earliest days of marketing the value of creating content which triggers an emotional response has been recognized as one of the most essential factors in creating engagement with an audience [158]. In contrast to episodes 7 and 8 the 3 most fast-paced and entertainment focused episodes (episodes 1, 4 and 10) which we define by those containing dramatic imagery and music, stories, and science-fiction style presentations of the future of health and technology performed very well. Both episodes 1 and 10 gained around 20,000 viewers throughout the duration of the episode when shown on TV. This is particularly notable for Episode 10 since the 3 previous episodes lost viewers throughout. Episode 10 viewership dropped significantly in the final minute after rising throughout the episode but this may be attributed to the audience skipping the end credits on the last episode.

Global health research with potential for public impact is often based on epidemiological studies which are largely impenetrable to the public. In such cases researchers could benefit from collaborations with skilled story-tellers and creatives who are able to extract authentic and compelling narratives showing how these issues relate to the lives of real people. This study showed that the interest in "core" global health topics was, as a rule, lower than in the topics which also have a more general appeal to the public - such as e.g. pandemic threat, human origins, or non-communicable diseases, to which the viewers could relate more strongly. If we aim to increase interest in, and attractiveness of global health topics to the general public, a feasible strategy would be to adjust

the language to that used in popular culture. Linking promotional materials to other popular topics that are dominating the public debate or capturing their interest would help to keep global health topics relevant outside of major news stories or crises.

5.5 Building an Audience

The high viewership from the very start of Episode 1 was quite unexpected and highlights the importance of extensive preparation and relationship building with audiences before launching an engagement campaign in order to reach a critical mass of supporters.

For one year leading up to the documentary airing the narrator posted to a public facebook page several times a week exploring popular science topics. This constant engagement with the Croatian public built up a core audience who then triggered extensive social media sharing of the news of the series launching. As a result of this online attention the narrator was invited to appear on several national television programmes and newspapers promoting the launch. The result was a large viewership of 152,322 for Episode 1 despite this being an entirely new series on Croatian television.

The success of a campaign needs to start with offering valuable content to the target audience on a regular, consistent basis. The very first posting of Episode 1 on Facebook yielded over 1000 views on Youtube and 274 likes. This approach builds real relationships with the audience who are then happier to engage when one has an important finding or global health message to convey. The existing audience need to care enough about the researcher and their work to activate their networks through social media sharing.

Unfortunately, many public engagement campaigns are only launched at the end of a project as an afterthought to announce key findings. Had we taken this approach it is unlikely that we would have surpassed 1000 views on Youtube in the first 5 days of posting the video. This observation is in step with modern

social media marketing strategy which emphasises the upfront provision of large amounts of valuable content to audiences before even considering asking them to engage more deeply with a project. [159] Reciprocity between the content creator and the audience is considered one of the most fundamental dynamics of a social media marketing campaign [160, 161].

The consistent, ongoing offering of value to an audience creates strong ties which are more likely last over multiple public engagement projects allowing a researcher to build a core audience over time. It is worth mentioning that the narrator went on to have two No. 1 bestselling popular science books in Croatia after the series had aired indicating the strength of the ties to the public can last beyond a single project.

It is important to consider that the public attention span has significantly shortened with the advent of social media [162]. Rapid scrolling through social media feeds is now a mainstream method of consuming media and global health media has not adapted quickly to this. A major challenge for the global health community in the future will be finding ways of communicating long-term goals to a public with a rapidly diminishing attention span.

I could likely have improved the response through Facebook by posting shorter pieces of content more frequently and with greater use of images instead of text [163]. One could easily argue that a long-form documentary format is not an optimal approach in a social-media environment. However I found the combination of regular, short and entertaining Facebook posts linking to the longer documentary episodes on Youtube to be a good combination.

A limitation of this study is that I only used Facebook to promote the documentary and of course there are many social media platforms each with their own culture and demographics. Catering the content to each platform and its individual culture, etiquette and style is an important aspect of social media marketing which I did not fully explore. Youtube is suited to longer-form videos and documentaries and Facebook to short, attention grabbing posts. Other

networks such as Instagram, Pinterest, LinkedIn and Tumblr have their own formats which would need to be understood in some depth in order for global health messages to come across as authentic on these networks. I found that the advantages of various platforms can be combined for example by driving traffic to longer Youtube content through short Facebook posts as in this study.

5.6 Engagement Windows

The phenomenon of a "policy window" which is well recognised in the field pf public health describes a window of opportunity where many conditions align to create the opportunity for a change in policy [164]. Such conditions are now studied to attempt to predict and prepare for opportune times for action [165]. A similar phenomenon seems to have occurred in this study where a window of public debate opened up on the issues of vaccines and so the video was able to make a significant impact. The two major conditions which seem to have catalysed the public response were the growing measles epidemic combined with the vocal anti-vaxxer movement in Croatia. Another potential factor that could have contributed to the interest of online newspaper portals to the videos was the timing of release during the two months of summer break, when news on politics or sport events do not dominate media space, as they do in the rest of the year.

Global health researchers can use such opportunities to deliver their message with much greater impact. There are examples of reforms and structural changes to the health care system being initiated in the wake of pandemics and similarly many charities raise a significant percentage of their funding during crises. Our study indicates that a there would be value in researchers being prepared for such windows of opportunity with a well-planned yet highly flexible- media campaign in place.

5.7 Limitations of this study

Perhaps the most significant limitation of this study is the use of Youtube advertising which uses algorithms that cannot be accessed or analysed. Youtube automatically assigns a different number of "impressions" of the advert according to how well it is performing. This made it impossible to control the number of views received by each advert and this varied quite significantly between the videos from 14,000 to 30,000. Additionally, it is unknown what further optimisations the Youtube algorithm performs, perhaps showing videos more frequently in countries or age-groups which respond better to them. To make the comparison between the videos as fair as possible I standardised the settings for the Youtube advertising campaign so that every setting was the same across all videos. I also turned off all targeting of the adverts so that they would be shown to as random as possible a selection of the public. The budget and length of campaign were exactly the same for all videos. I also made an individual campaign for each video so that Youtube would not optimise the videos performance against each other, for example by assigning higher budget to a well performing advert. However even with all of these considerations it is still impossible to know exactly what kinds of optimisations were performed by Youtube afterwards.

For these reasons I set the campaign bidding strategy to reach large audiences of several thousand per video to increase sample size and have been modest in my analysis of the Youtube advertising data, presenting it as real-life example of what happens when advertising global health messaging. This has its own value in that I was able to compare the response to the advertised videos with those which were shared organically. The engagement was clearly far higher with those which were naturally shared receiving 154 likes on average per video whereas the advertised content received almost no likes despite the much larger view count. However this would be somewhat expected given that the advertised audience was not in any way targeted to reach those interested in science or global health and the shared content was within a group interested in such subjects.

The strongest marker of engagement in the advertising study was the percentage of people who watched the entire video. It is quite a commitment to be diverted for 15-20 minutes by an advert when browsing Youtube and this gave an indication of real interest in the topic. This retention rate varied from 2-4% among the videos and I would predict this to be significantly higher had I specifically targeted those likely to be interested in global health topics. For example I could have shown the video only to those searching for "global health", "vaccination" or "pandemics" and would likely have seen much higher retention rates than in a generic population. This result shows that even with no targeting or manual optimisation the videos reached a small percentage of people who became engaged with the content. Due to the tiny cost per view for such ads a standard commercial marketing strategy could be applied where the ads are shown to a very large group of people to reach small percentages who are interested in the content. This can then be optimised over time by finding which populations are the most productive to engage with.

Despite these limitations several valuable conclusions were reached. There have been many studies into the effectiveness of mass media campaigns in global health as detailed earlier in the literature review of this PhD. However there is very little literature on the use of social media and digital advertising. This study has shown that even in a "worst-case scenario" with no targeting or optimisation of any kind Youtube advertising can generate significant engagement in a small percentage of people. With further optimisation of this process these numbers could become quite significant. Additionally, advertising has other benefits in that it is very cheap and can reach large numbers of people quickly. Overall, engagement is likely to be far higher by organically reaching smaller audiences of people interested in the video topic through online sharing. However advertising may be an effective supplement to this approach or a means to reach much larger audiences than would otherwise be possible.

5.7.1 Generalisability of Findings

The public engagement work in this thesis promoted the global health messaging of Professor Igor Rudan who already had a large following among the Croatian public. Inevitably many of the results therefore reflect the engagement of Croatian intellectuals with the topics and this could raise some doubt over their generalisability. However, there were several indications throughout the studies which indicate the results do reflect more general public engagement with global health topics. One of the key indications which point to a generalisability of the results came from the average view duration (AVD) comparisons between the videos. In this analysis, Episode 4 and 6 were clear outliers with the highest view durations whether they were promoted to Prof. Rudan's following or randomly to the general world population through un-targeted YouTube advertising. Similarly, Episode 7 consistently achieved the lowest AVD both when promoted to Prof. Rudan's followers and to the general world population through YouTube advertising. Such results would be highly surprising if there were not some inherent appeal of these episodes to both populations. The viral spread of Episode 4 demonstrated that with Professor Rudan's following given as a constant still this episode significantly outperformed all others indicating influential factors beyond just Professor Rudan's following. The AVD for this episode was similarly higher than most of the other episodes when using general YouTube advertising and this would seem to indicate a heightened interest in the topics of Pandemics and Vaccination in the general population as well as Professor Rudan's following.

It is also worth noting that any scientific researcher is more likely to have a more significant following and reach in their home-country and so studying engagement within this context may yield results which will translate well to effective strategies in real-world scenarios. Only a few outlier scholars such as Neil deGrasse Tyson and Michio Kaku have a general world-wide following and often this has been built slowly through initial popularity built up in their country of residence and work. If this research were carried out in a vacuum many valuable insights into the spread of content from social to national media

which researchers are likely to encounter in their own country would have been missed. The results of such a study may be less generalizable than those of a real-life scenario.

Another factor influencing the generalisability of this research is that the following of Professor Rudan among the Croatian population was already quite large when the study began and this would not reflect the starting point of an average researcher when engaging in a public engagement campaign. However, there are several reasons why beginning with an existing audience made the studies more valuable than if this had not been the case. The first is simply the sample size. The larger audience allowed studies to be conducted where the less popular engagement metrics such as likes, shares and comments received numbers in sufficient quantity to analyse them alongside the views and other more popular metrics. This would not have been possible until much later in the study had there not been a sufficient audience to begin with.

The greatest evidence that real impact has been generated beyond the initial following is that there were clear outlier results in the engagement metrics indicating additional factors at work beyond the initial audience. Episode 4 provides the clearest indication of this and was clearly caused by the episode content aligning with a national debate around vaccination. This yielded one of the most helpful insights of the study showing the importance of creating global health media content which contributes to current public debates in the media. Perhaps the main improvement which could have been implemented to understand the generalisability of the results would have been to have reported separate results from within and without the Croatian public. This would have allowed for some additional insight into how topics of interest in the Croatian media affected the results.

5.7.2 What Constitutes True Engagement?

An inherent difficulty with all public engagement campaigns using social media is understanding what really constitutes engagement. In the literature review of

this thesis papers which measured social media metrics were reviewed and the majority focused on measuring views and likes. It would be fair to say that these metrics signify the most superficial engagement with social media material and may or may not be strongly associated with changes in public perception and gains in knowledge. The difficulty of making an accurate assessment of such outcomes is a problem for many global health campaigns as large sample sizes are needed to gain a sufficient overview of the impact of a campaign on public perception. In the case of crowdfunding campaigns the clear end goal is to raise a certain amount of funding and this can be a very helpful measure against which to evaluate the engagement quality of social media content. Large scale changes in public perception are certainly possible through media interventions as evidenced by the change in smoking behaviours in response to mass media campaigns detailed in the literature review. However, these are quite rare and isolated examples in the history of global heath which were backed by large funding bodies. In the case of the Croatian television and globally advertised YouTube study it would have been very difficult to collect a sufficient amount of data on public opinion and perception to assess the impact of the video over such large populations. However, in the study using unadvertised promotion through Facebook it may have been possible to use surveys before and after viewing and this could have allowed for a deeper insight into which engagement metrics were associated with a change in public perception or gains in knowledge.

The way forward for global health public engagement campaigns will need to include clear end-goal metrics which will by necessity be quite different across campaigns. It has been demonstrated that social media metrics can be predictive of financial outcomes and firm equity value for companies [167]. Similarly, it might be demonstrated that certain engagement metrics and combinations of metrics could be associated more with certain global health outcomes. Fundraising, changes in policy, influencing health behaviours and bridging the gaps in knowledge between the scientific community and the public are among the many diverse goals sought by global health campaigns. Having these clearly defined end-goals with associated metrics will allow researchers to see the value of social media engagement and will give many insights into how to optimise for

the right outcomes. This would also avoid one of the dangers of social media engagement which is to encourage optimisation toward superficial metrics and achieve large numbers with little meaningful impact. Measurement of more subjective measures such as changes in public perception will need to be carried out with adequate sample size to obtain significant insights and social media surveys may prove to be the solution for obtaining this kind of data without significant cost. Online survey platforms provide the opportunity for nearly unlimited distribution of surveys and could be linked to the video in video overlays.

Another improvement which could have been made to this research would have been to try to isolate more effectively which elements of the videos were associated with increased engagement metrics. General trends such as a preference for more narrative driven dramatic presentation styles were noted, and it would be interesting to analyse these in more detail. A report on science communication for the Royal Institution also noted the importance of such an analysis and suggested adapting econometrics methods to analyse which video features relate to increased engagement metrics [168]. Researchers and consultancies have used econometric methods to link social media engagement metrics to outcomes such as sales and brand engagement [169, 170]. Research in the field of computational social science has demonstrated that social media activity can predict a vast range of outcomes from movie sales to epidemic outbreaks [171, 172]. Additionally linear regression models have been developed to predict iPhone sales from analysis of twitter activity [173]. It is important therefore to gather as much data as possible from media platforms to leverage the insights econometrics methods may facilitate. Throughout the study I consulted with Google over phone support to ensure I received all of the available metrics for the YouTube studies and with Croatian television to receive available data from AGB Neilsen. Global Health researchers should seek further collaboration where possible with such entities to maximise the amount of data available for analysis.

Econometric methods and sophisticated social media analysis on the effect of engagement metrics on end-goal outcomes could provide great benefit to global health public engagement campaigns. This study has given one of the first insights into the video features determining engagement with global health social media materials and the metrics which reflect engagement with them. Future work should be performed to develop consistent, repeatable methods of analysis which are proven to be predictive of well-defined end goals.

Chapter 6: Conclusions

From this work, it may concluded that the major challenge of promoting global health health videos online is the long-term development focus of global health topics in contrast to a shortening media and public attention span. This was reflected throughout the study in the low engagement with videos on sustainable development goals or internal matters of global health policy and development (episodes 7 and 8). And in the far higher engagement with videos of story-based content with dramatic visuals and music (episodes 1, 4 and 10).

Across the studies this research identified 5 main factors contributing the success of videos which performed well.

1. Contribution to public debate.
2. Timing of release within windows of opportunity for increased engagement.
3. Promotion by global health figure with authentic scientific background.
4. Positive emotional valency.
5. Entertainment value of content (Narrative formats, dramatic presentation.)

The public primarily looks to social media for entertainment and in such an environment it can be incredibly difficult to promote the complex humanitarian and scientific global health agenda against waves of short-form highly entertaining media "candy". However the clear outlier result in the viral spread of Episode 4 proved that it is possible to cut through the social media noise quite effectively.

The unique viral spread of Episode 4 resulting in national television broadcast to over one million viewers illustrated the value of what I have called "engagement windows" in this study. I define an "engagement window" as a unique combination of circumstances that open the opportunity for an unusually high level of engagement with the public. In the case of Episode 4 three main factors catalysed this engagement window:

1. The presence of a vocal anti-vaxxer movement in Croatia.
2. The outbreak of measles in the Croatian population.
3. The need for a credible scientific voice in the public debate.

The combination of these three factors led to high levels of engagement with the video, viral sharing and national broadcast among the population.

However such an opportunity was only able to be taken advantage of after extensive preparation. An enthusiastic core audience needs to built in advance of such times in order to reach a critical mass of supporters and trigger network effects and viral sharing when a window of opportunity arises. This can be achieved with consistent offering of valuable media content to supporters through social media which builds relationships and support for a project. This needs to be a consistent, regular (daily if possible) effort throughout a project in order to generate real engagement and support, not an afterthought at the end of a project.

Another important lesson learned was that the public are more receptive to content which is positive, entertaining and fits in with their current interests. However this kind of engagement is not necessarily the deep engagement that many global health organisations look for. Many use media as a means of escape from the harsh realities of daily life and do not want to engage with heavy subject matter while looking for escape and entertainment. This was reflected in the very low values in the basic engagement metrics such as views and likes for the episode on “Ageing and Dying” indicating less initial attention from the audience. However, this episode also received the highest view duration through both Facebook promotion and national television indicating a deep level of engagement from those who did choose to view it. Clearly many global health topics deal with serious and sometimes tragic subject matter. In such cases creative approaches to communicate inspiring stories of the action taken to solve problems may prove effective in achieving initial attention. However, long-form, in-depth content should then be used to drive

deeper engagement with these topics once attention has been captured. This points to a model of capturing attention through positive, entertaining content and then building engagement through in-depth material for those who wish to deepen their engagement. Long-term engagement with viewers needs to be fostered through primarily positive interactions as audiences become fatigued with traditional guilt-based or negative emotional appeals. The often light-hearted, positive and pro-active approach of Bill Gates personal blog is an excellent example of how to deal with difficult topics in a positive way [174].

This discrepancy between low engagement noted in simple metrics such as views and likes and high engagement noted through deeper metrics such as average view duration further indicates the need for a fully rounded assessment of all available metrics to evaluate engagement. As I have noted this will be of particular importance to charity fundraising campaigns where the majority of donations can stem from a highly engaged minority of viewers. Campaigns which produce high numbers of views will not necessarily translate to high numbers of donors. Noticing these dynamics early in a campaign can help to adjust the strategy to achieve both high viewership and high engagement.

Having a narrator with an authentic scientific background gave credibility to the message in the videos, the value of which was reflected in the comments posted in the online news portals [150]. In other areas of popular science many of the most effective popularisers have a significant background in research and study. The global health community has a unique voice to contribute to public debate but few public facing figureheads to create a strong media identity. The values of science, equality and equity, technology and long term perspective were the key messages we instilled in each episode and led to a favourable reaction from the public.

Many of these insights are reflected to some degree in social media marketing research indicating that these are not necessarily specific to global health promotion. The global health community could benefit greatly from adopting

some of the social media marketing strategies currently being used in the commercial world. An interdisciplinary approach to public engagement could successfully combine the work of highly skilled creatives with academics.

Through a combination of these strategies the global health community could approach its engagement with the public as an on-going mutually beneficial interaction distilling complex long term development goals into entertaining content which gradually invites the audience to a deeper understanding of global health issues.

Chapter 7.
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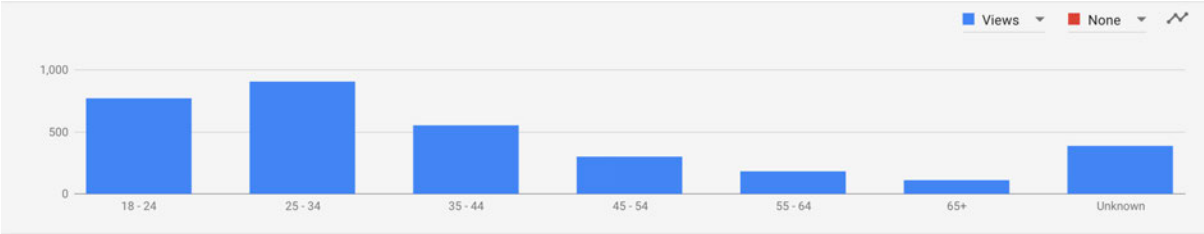
Appendix 1.
Data from YouTube Analytics on the Viewership for Each Episode.

Survival Episode 1 Demographics

Age



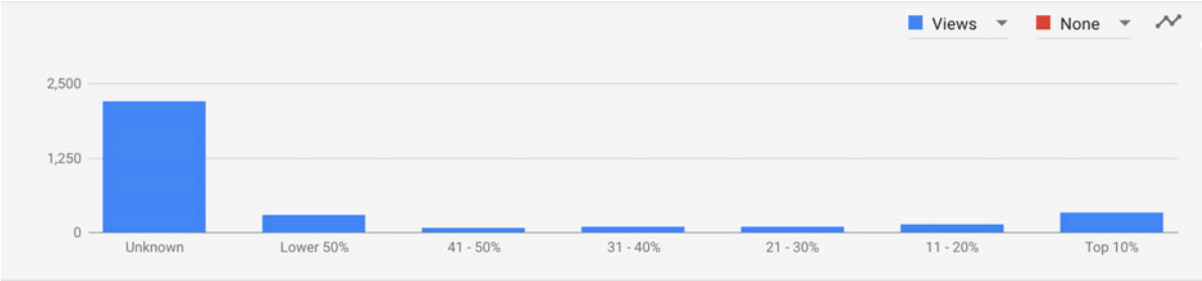
Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	4,977	763	15.33%	£0.03	£25.98	0.00	£0.00	0.00%
25 - 34	Campaign ended	5,593	903	16.15%	£0.03	£28.78	0.00	£0.00	0.00%
35 - 44	Campaign ended	3,179	549	17.27%	£0.03	£16.04	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,533	300	19.57%	£0.03	£7.55	0.00	£0.00	0.00%
55 - 64	Campaign ended	1,002	180	17.96%	£0.03	£4.79	0.00	£0.00	0.00%
65+	Campaign ended	529	105	19.85%	£0.02	£2.55	0.00	£0.00	0.00%
Unknown	Campaign ended	2,801	383	13.67%	£0.04	£14.42	0.00	£0.00	0.00%
Total: Ages		19,614	3,183	16.23%	£0.03	£100.12	0.00	£0.00	0.00%

Gender

ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	6,211	1,049	16.89%	£0.03	£32.11	0.00	£0.00	0.00%
Male	Campaign ended	11,549	1,845	15.98%	£0.03	£58.76	0.00	£0.00	0.00%
Unknown	Campaign ended	1,854	289	15.59%	£0.03	£9.24	0.00	£0.00	0.00%
Total: Genders		19,614	3,183	16.23%	£0.03	£100.12	0.00	£0.00	0.00%

Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	2,347	329	14.02%	£0.04	£12.63	0.00	£0.00	0.00%
11 - 20%	Campaign ended	1,097	135	12.31%	£0.04	£5.84	0.00	£0.00	0.00%
21 - 30%	Campaign ended	718	89	12.40%	£0.04	£3.85	0.00	£0.00	0.00%
31 - 40%	Campaign ended	602	88	14.62%	£0.04	£3.25	0.00	£0.00	0.00%
41 - 50%	Campaign ended	369	61	16.53%	£0.03	£1.94	0.00	£0.00	0.00%
Lower 50%	Campaign ended	1,705	280	16.42%	£0.03	£9.39	0.00	£0.00	0.00%
Unknown	Campaign ended	12,776	2,201	17.23%	£0.03	£63.22	0.00	£0.00	0.00%
Total: Household...		19,614	3,183	16.23%	£0.03	£100.12	0.00	£0.00	0.00%

Parental Status

ADD FILTER Ad group view

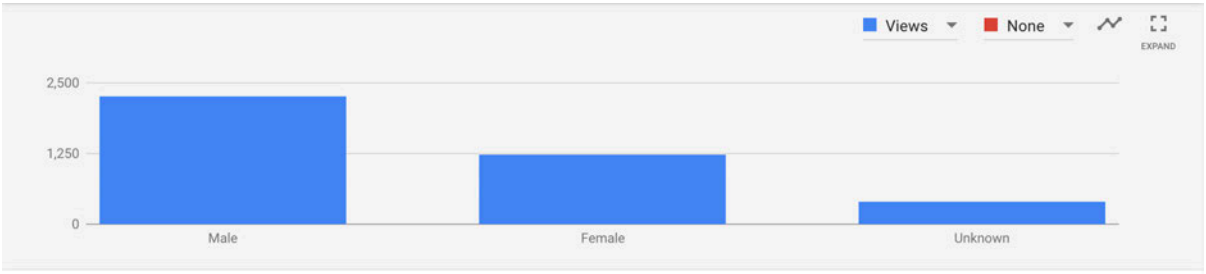
Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	12,165	1,711	14.06%	£0.04	£63.61	0.00	£0.00	0.00%
Parent	Campaign ended	3,497	584	16.70%	£0.03	£17.67	0.00	£0.00	0.00%
Unknown	Campaign ended	3,952	888	22.47%	£0.02	£18.84	0.00	£0.00	0.00%
Total: Parental s...		19,614	3,183	16.23%	£0.03	£100.12	0.00	£0.00	0.00%

Survival Episode 2 Demographics

Age

Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	4,910	929	18.92%	£0.03	£25.07	0.00	£0.00	0.00%
25 - 34	Campaign ended	5,757	1,074	18.66%	£0.03	£28.28	0.00	£0.00	0.00%
35 - 44	Campaign ended	3,492	690	19.76%	£0.02	£16.89	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,580	340	21.52%	£0.02	£7.30	0.00	£0.00	0.00%
55 - 64	Campaign ended	1,011	213	21.07%	£0.02	£4.70	0.00	£0.00	0.00%
65+	Campaign ended	624	129	20.67%	£0.02	£2.90	0.00	£0.00	0.00%
Unknown	Campaign ended	3,014	479	15.89%	£0.03	£14.94	0.00	£0.00	0.00%
Total: Ages		20,388	3,854	18.90%	£0.03	£100.08	0.00	£0.00	0.00%
Total: Other		0	0	–	–	£0.00	–	–	–
Total: Ad gr...		20,388	3,854	18.90%	£0.03	£100.08	0.00	£0.00	0.00%

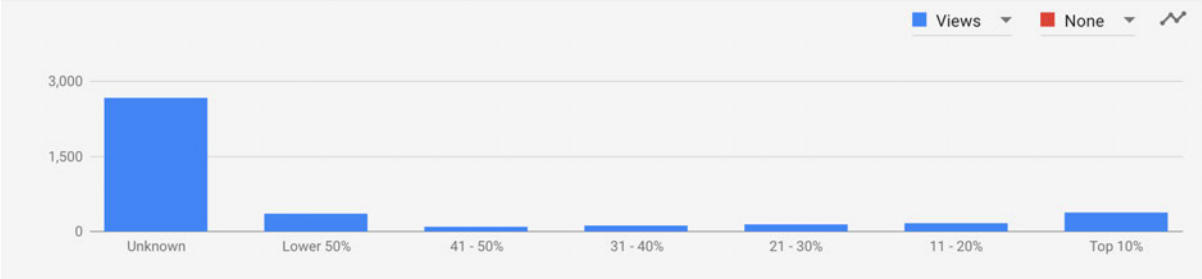
Gender



ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

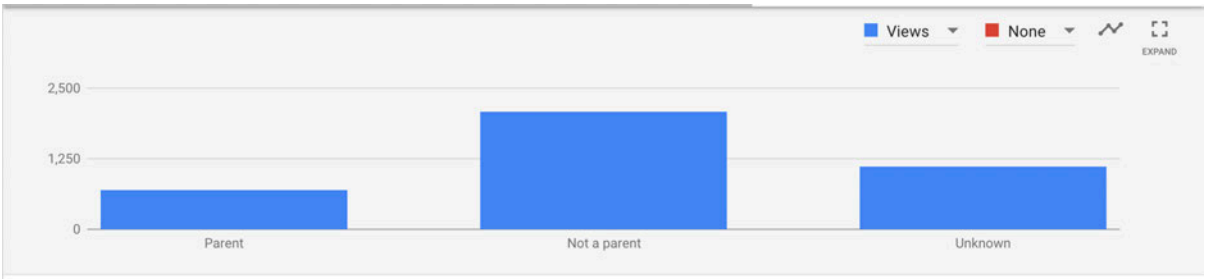
Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	6,593	1,212	18.38%	£0.03	£32.32	0.00	£0.00	0.00%
Male	Campaign ended	11,796	2,254	19.11%	£0.03	£58.32	0.00	£0.00	0.00%
Unknown	Campaign ended	1,999	388	19.41%	£0.02	£9.44	0.00	£0.00	0.00%
Total: Gende...		20,388	3,854	18.90%	£0.03	£100.08	0.00	£0.00	0.00%

Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	2,241	368	16.42%	£0.03	£12.03	0.00	£0.00	0.00%
11 - 20%	Campaign ended	1,129	163	14.44%	£0.04	£5.85	0.00	£0.00	0.00%
21 - 30%	Campaign ended	706	129	18.27%	£0.03	£3.70	0.00	£0.00	0.00%
31 - 40%	Campaign ended	573	112	19.55%	£0.03	£2.96	0.00	£0.00	0.00%
41 - 50%	Campaign ended	375	81	21.60%	£0.02	£1.92	0.00	£0.00	0.00%
Lower 50%	Campaign ended	1,724	352	20.42%	£0.03	£9.21	0.00	£0.00	0.00%
Unknown	Campaign ended	13,640	2,649	19.42%	£0.02	£64.41	0.00	£0.00	0.00%
Total: Hous...		20,388	3,854	18.90%	£0.03	£100.08	0.00	£0.00	0.00%
Total: Other		0	0	–	–	£0.00	–	–	–
Total: Ad gr...		20,388	3,854	18.90%	£0.03	£100.08	0.00	£0.00	0.00%

Parental Status

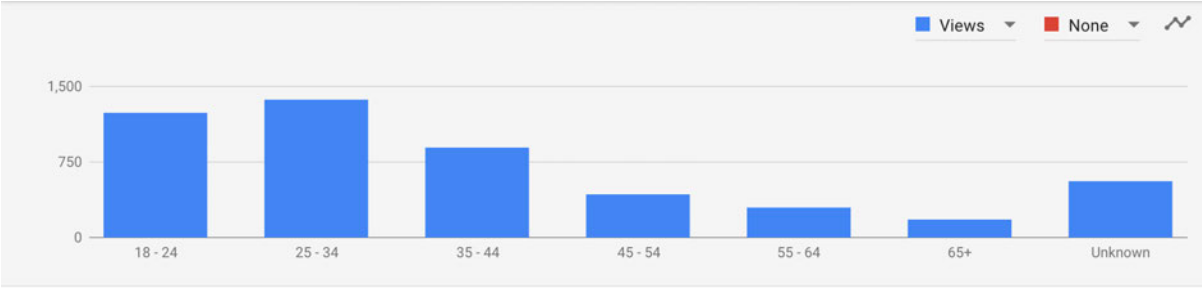


ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	12,184	2,081	17.08%	£0.03	£61.68	0.00	£0.00	0.00%
Parent	Campaign ended	3,735	677	18.13%	£0.03	£18.17	0.00	£0.00	0.00%
Unknown	Campaign ended	4,469	1,096	24.52%	£0.02	£20.23	0.00	£0.00	0.00%
Total: Paren...		20,388	3,854	18.90%	£0.03	£100.08	0.00	£0.00	0.00%

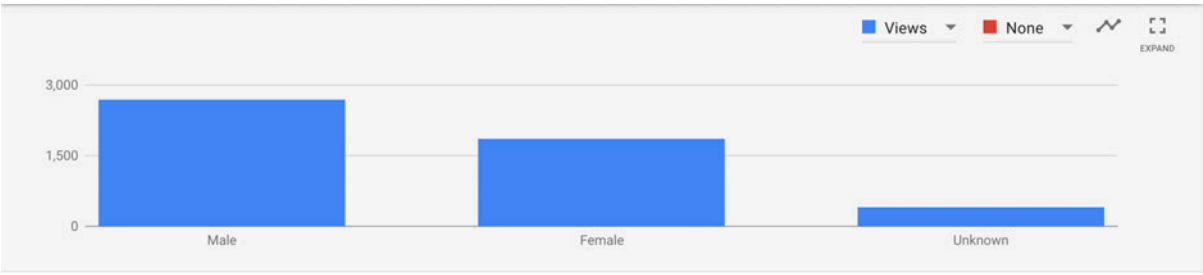
Survival Episode 3 Demographics

Age



Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	8,438	1,234	14.62%	£0.05	£59.70	0.00	£0.00	0.00%
25 - 34	Campaign ended	8,454	1,364	16.13%	£0.04	£58.90	0.00	£0.00	0.00%
35 - 44	Campaign ended	5,202	886	17.03%	£0.04	£35.90	0.00	£0.00	0.00%
45 - 54	Campaign ended	2,422	425	17.55%	£0.04	£15.67	0.00	£0.00	0.00%
55 - 64	Campaign ended	1,421	288	20.27%	£0.03	£8.94	0.00	£0.00	0.00%
65+	Campaign ended	910	176	19.34%	£0.03	£5.80	0.00	£0.00	0.00%
Unknown	Campaign ended	4,179	549	13.14%	£0.05	£30.08	0.00	£0.00	0.00%
Total: Ages		31,026	4,922	15.86%	£0.04	£215.00	0.00	£0.00	0.00%

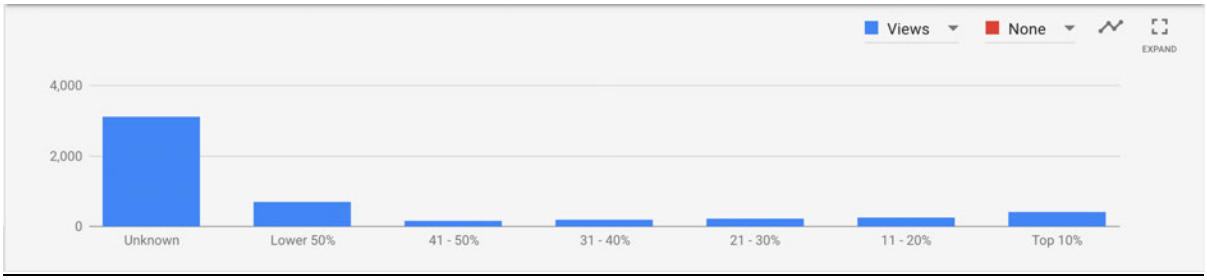
Gender



ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

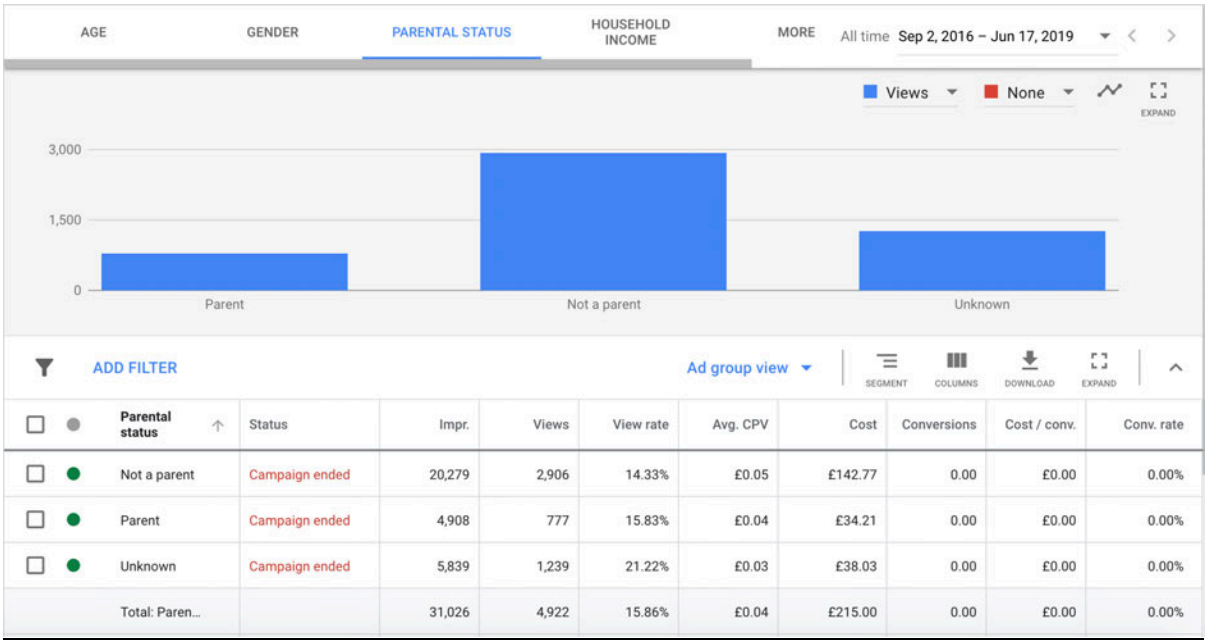
Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	11,470	1,851	16.14%	£0.04	£78.98	0.00	£0.00	0.00%
Male	Campaign ended	17,045	2,677	15.71%	£0.04	£118.50	0.00	£0.00	0.00%
Unknown	Campaign ended	2,511	394	15.69%	£0.04	£17.52	0.00	£0.00	0.00%
Total: Gende...		31,026	4,922	15.86%	£0.04	£215.00	0.00	£0.00	0.00%

Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	3,023	389	12.87%	£0.06	£22.11	0.00	£0.00	0.00%
11 - 20%	Campaign ended	1,864	230	12.34%	£0.06	£13.16	0.00	£0.00	0.00%
21 - 30%	Campaign ended	1,369	194	14.17%	£0.05	£9.94	0.00	£0.00	0.00%
31 - 40%	Campaign ended	1,121	178	15.88%	£0.04	£7.83	0.00	£0.00	0.00%
41 - 50%	Campaign ended	855	128	14.97%	£0.05	£6.31	0.00	£0.00	0.00%
Lower 50%	Campaign ended	4,209	692	16.44%	£0.04	£31.10	0.00	£0.00	0.00%
Unknown	Campaign ended	18,585	3,111	16.74%	£0.04	£124.55	0.00	£0.00	0.00%
Total: Hous...		31,026	4,922	15.86%	£0.04	£215.00	0.00	£0.00	0.00%

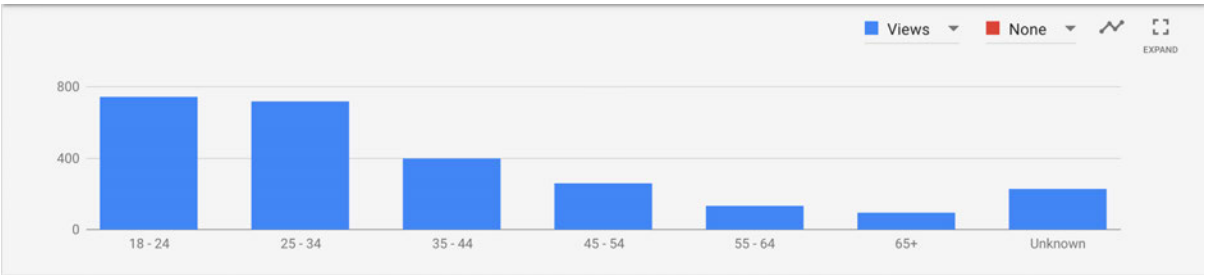
Parental Status



Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	20,279	2,906	14.33%	£0.05	£142.77	0.00	£0.00	0.00%
Parent	Campaign ended	4,908	777	15.83%	£0.04	£34.21	0.00	£0.00	0.00%
Unknown	Campaign ended	5,839	1,239	21.22%	£0.03	£38.03	0.00	£0.00	0.00%
Total: Paren...		31,026	4,922	15.86%	£0.04	£215.00	0.00	£0.00	0.00%

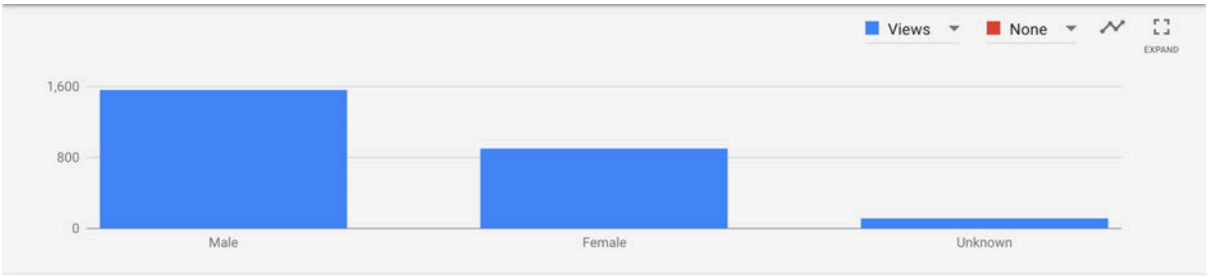
Survival Episode 4 Demographics

Age



Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	5,491	739	13.46%	£0.05	£38.89	0.00	£0.00	0.00%
25 - 34	Campaign ended	4,746	717	15.11%	£0.05	£33.10	0.00	£0.00	0.00%
35 - 44	Campaign ended	2,607	394	15.11%	£0.04	£17.68	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,370	260	18.98%	£0.03	£8.70	0.00	£0.00	0.00%
55 - 64	Campaign ended	721	128	17.75%	£0.04	£4.53	0.00	£0.00	0.00%
65+	Campaign ended	491	91	18.53%	£0.03	£3.04	0.00	£0.00	0.00%
Unknown	Campaign ended	1,925	223	11.58%	£0.06	£13.66	0.00	£0.00	0.00%
Total: Ages		17,351	2,552	14.71%	£0.05	£119.61	0.00	£0.00	0.00%

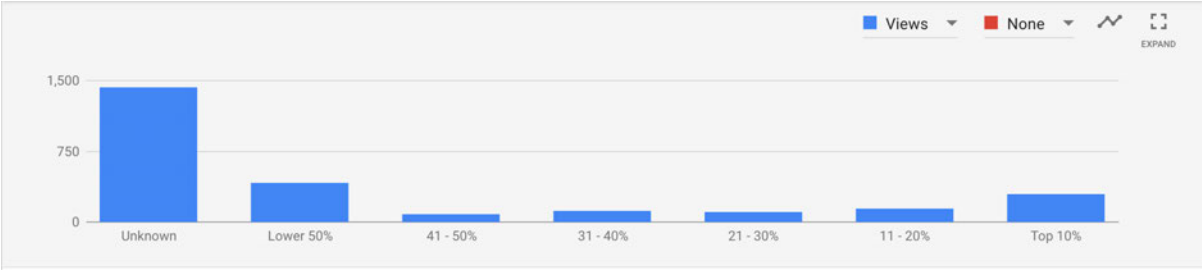
Gender



ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

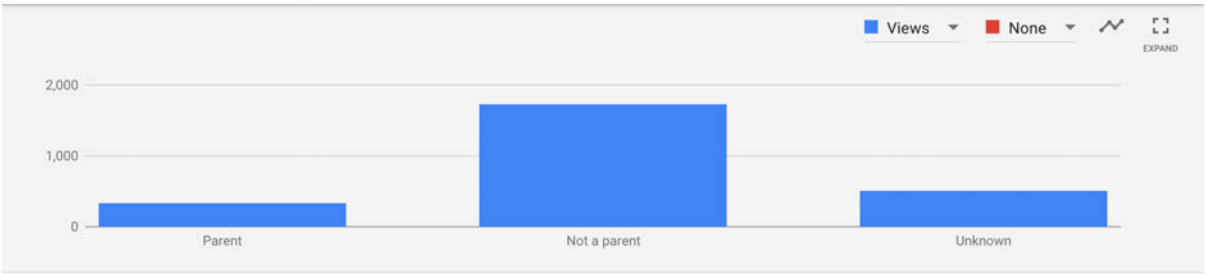
Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	5,847	890	15.22%	£0.04	£39.80	0.00	£0.00	0.00%
Male	Campaign ended	10,709	1,555	14.52%	£0.05	£74.33	0.00	£0.00	0.00%
Unknown	Campaign ended	795	107	13.46%	£0.05	£5.48	0.00	£0.00	0.00%
Total: Gende...		17,351	2,552	14.71%	£0.05	£119.61	0.00	£0.00	0.00%

Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	2,554	294	11.51%	£0.06	£18.32	0.00	£0.00	0.00%
11 - 20%	Campaign ended	1,269	139	10.95%	£0.06	£8.99	0.00	£0.00	0.00%
21 - 30%	Campaign ended	858	99	11.54%	£0.06	£6.10	0.00	£0.00	0.00%
31 - 40%	Campaign ended	740	110	14.86%	£0.05	£5.29	0.00	£0.00	0.00%
41 - 50%	Campaign ended	546	77	14.10%	£0.05	£3.91	0.00	£0.00	0.00%
Lower 50%	Campaign ended	2,652	415	15.65%	£0.05	£19.07	0.00	£0.00	0.00%
Unknown	Campaign ended	8,732	1,418	16.24%	£0.04	£57.93	0.00	£0.00	0.00%
Total: Hous...		17,351	2,552	14.71%	£0.05	£119.61	0.00	£0.00	0.00%

Parental Status

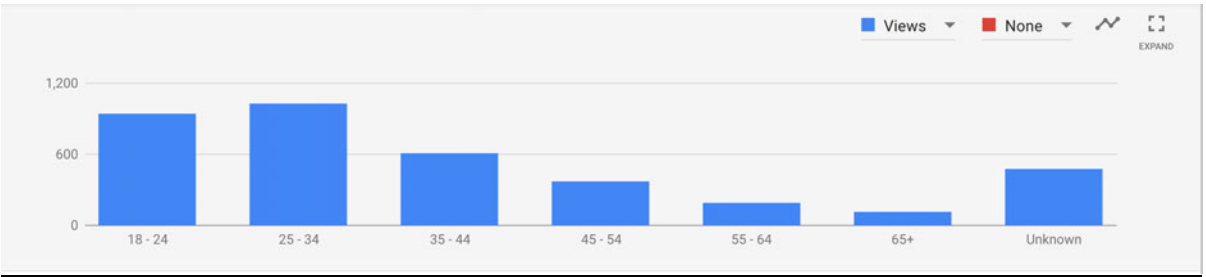


ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	12,790	1,728	13.51%	£0.05	£89.56	0.00	£0.00	0.00%
Parent	Campaign ended	1,922	321	16.70%	£0.04	£12.83	0.00	£0.00	0.00%
Unknown	Campaign ended	2,639	503	19.06%	£0.03	£17.22	0.00	£0.00	0.00%
Total: Paren...		17,351	2,552	14.71%	£0.05	£119.61	0.00	£0.00	0.00%

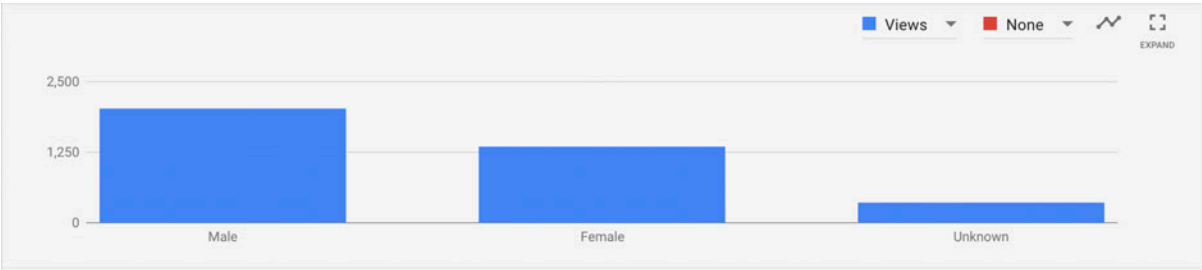
Survival Episode 5 Demographics

Age



Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	7,081	935	13.20%	£0.05	£51.20	0.00	£0.00	0.00%
25 - 34	Campaign ended	6,909	1,027	14.86%	£0.05	£48.55	0.00	£0.00	0.00%
35 - 44	Campaign ended	3,999	602	15.05%	£0.05	£27.76	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,955	371	18.98%	£0.04	£13.05	0.00	£0.00	0.00%
55 - 64	Campaign ended	1,028	188	18.29%	£0.04	£6.87	0.00	£0.00	0.00%
65+	Campaign ended	631	111	17.59%	£0.04	£4.20	0.00	£0.00	0.00%
Unknown	Campaign ended	3,764	468	12.43%	£0.06	£26.51	0.00	£0.00	0.00%
Total: Ages		25,367	3,702	14.59%	£0.05	£178.14	0.00	£0.00	0.00%

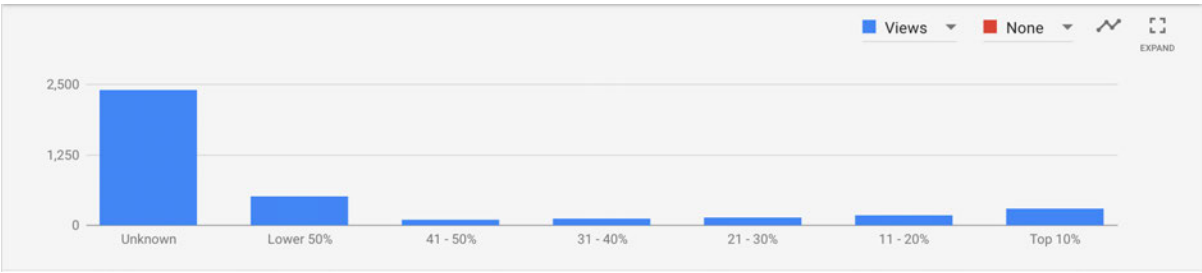
Gender



ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

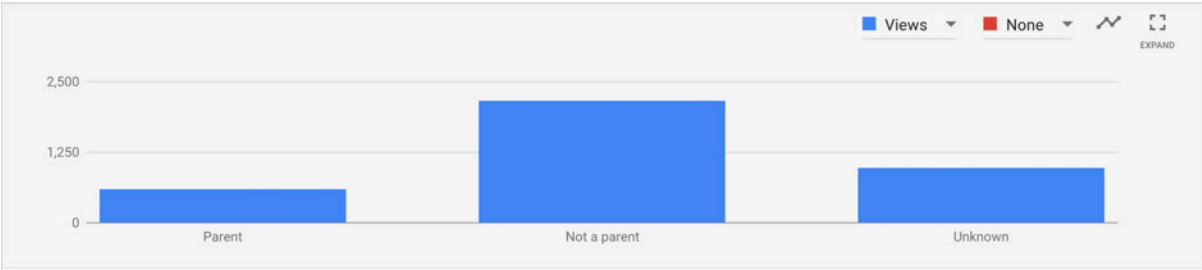
Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	8,452	1,337	15.82%	£0.04	£59.10	0.00	£0.00	0.00%
Male	Campaign ended	14,546	2,023	13.91%	£0.05	£103.02	0.00	£0.00	0.00%
Unknown	Campaign ended	2,369	342	14.44%	£0.05	£16.02	0.00	£0.00	0.00%
Total: Gende...		25,367	3,702	14.59%	£0.05	£178.14	0.00	£0.00	0.00%

Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	2,518	293	11.64%	£0.06	£18.50	0.00	£0.00	0.00%
11 - 20%	Campaign ended	1,527	178	11.66%	£0.06	£11.15	0.00	£0.00	0.00%
21 - 30%	Campaign ended	1,068	130	12.17%	£0.06	£7.74	0.00	£0.00	0.00%
31 - 40%	Campaign ended	917	113	12.32%	£0.06	£6.72	0.00	£0.00	0.00%
41 - 50%	Campaign ended	645	90	13.95%	£0.05	£4.59	0.00	£0.00	0.00%
Lower 50%	Campaign ended	3,247	501	15.43%	£0.05	£24.02	0.00	£0.00	0.00%
Unknown	Campaign ended	15,445	2,397	15.52%	£0.04	£105.42	0.00	£0.00	0.00%
Total: Hous...		25,367	3,702	14.59%	£0.05	£178.14	0.00	£0.00	0.00%

Parental Status

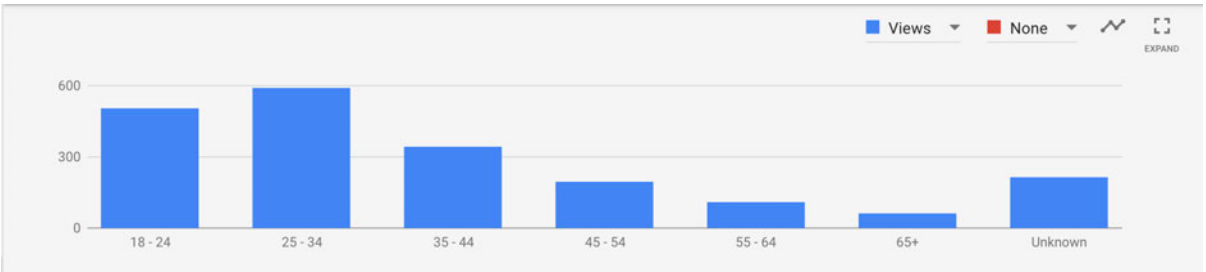


ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	16,653	2,159	12.96%	£0.06	£119.43	0.00	£0.00	0.00%
Parent	Campaign ended	3,797	578	15.22%	£0.05	£26.64	0.00	£0.00	0.00%
Unknown	Campaign ended	4,917	965	19.63%	£0.03	£32.07	0.00	£0.00	0.00%
Total: Paren...		25,367	3,702	14.59%	£0.05	£178.14	0.00	£0.00	0.00%

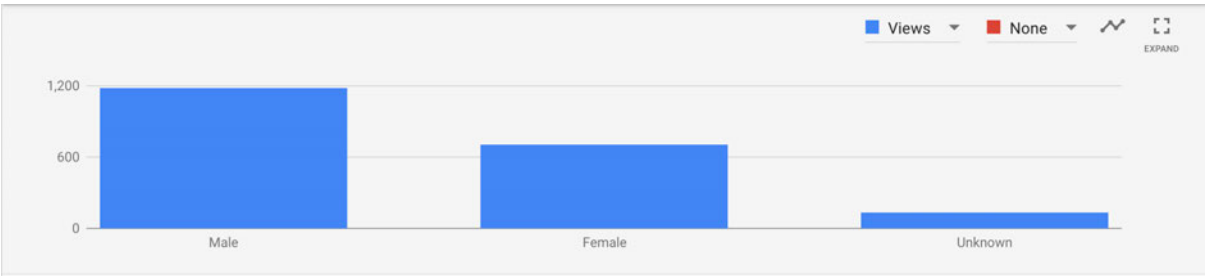
Survival Episode 6 Demographics

Age



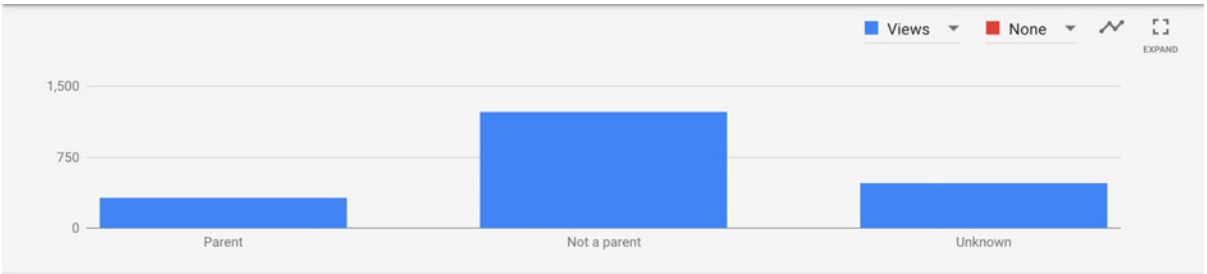
Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	4,093	504	12.31%	£0.06	£29.09	0.00	£0.00	0.00%
25 - 34	Campaign ended	4,107	589	14.34%	£0.05	£28.23	0.00	£0.00	0.00%
35 - 44	Campaign ended	2,296	340	14.81%	£0.05	£15.45	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,196	191	15.97%	£0.04	£7.95	0.00	£0.00	0.00%
55 - 64	Campaign ended	651	109	16.74%	£0.04	£4.12	0.00	£0.00	0.00%
65+	Campaign ended	372	61	16.40%	£0.04	£2.42	0.00	£0.00	0.00%
Unknown	Campaign ended	1,791	212	11.84%	£0.06	£12.81	0.00	£0.00	0.00%
Total: Ages		14,506	2,006	13.83%	£0.05	£100.08	0.00	£0.00	0.00%

Gender



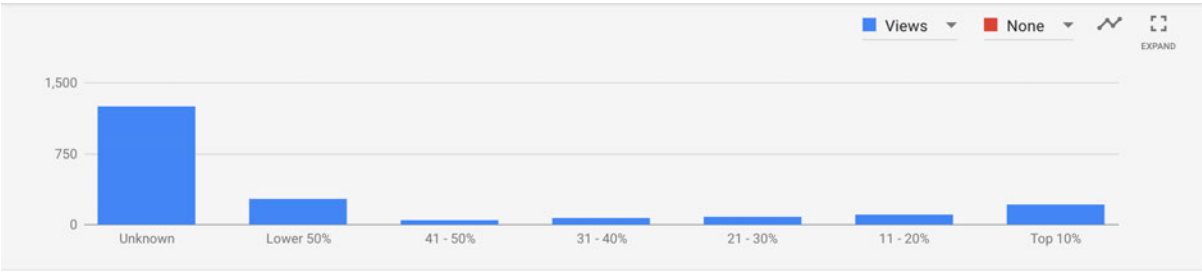
Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	5,009	699	13.95%	£0.05	£34.42	0.00	£0.00	0.00%
Male	Campaign ended	8,505	1,176	13.83%	£0.05	£58.91	0.00	£0.00	0.00%
Unknown	Campaign ended	992	131	13.21%	£0.05	£6.75	0.00	£0.00	0.00%
Total: Gende...		14,506	2,006	13.83%	£0.05	£100.08	0.00	£0.00	0.00%

Parental Status



Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	9,742	1,225	12.57%	£0.06	£68.49	0.00	£0.00	0.00%
Parent	Campaign ended	2,274	315	13.85%	£0.05	£15.52	0.00	£0.00	0.00%
Unknown	Campaign ended	2,490	466	18.71%	£0.03	£16.07	0.00	£0.00	0.00%
Total: Paren...		14,506	2,006	13.83%	£0.05	£100.08	0.00	£0.00	0.00%

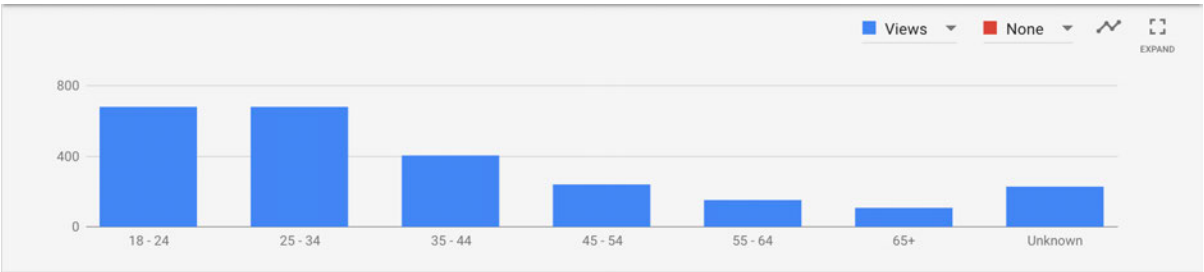
Household Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	1,785	204	11.43%	£0.06	£12.83	0.00	£0.00	0.00%
11 - 20%	Campaign ended	950	101	10.63%	£0.07	£6.88	0.00	£0.00	0.00%
21 - 30%	Campaign ended	672	81	12.05%	£0.06	£4.89	0.00	£0.00	0.00%
31 - 40%	Campaign ended	522	62	11.88%	£0.06	£3.86	0.00	£0.00	0.00%
41 - 50%	Campaign ended	376	45	11.97%	£0.06	£2.78	0.00	£0.00	0.00%
Lower 50%	Campaign ended	1,892	264	13.95%	£0.05	£14.23	0.00	£0.00	0.00%
Unknown	Campaign ended	8,309	1,249	15.03%	£0.04	£54.61	0.00	£0.00	0.00%
Total: Hous...		14,506	2,006	13.83%	£0.05	£100.08	0.00	£0.00	0.00%

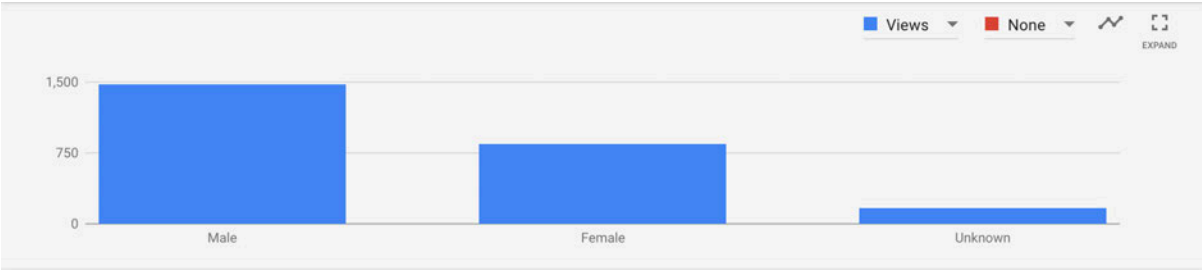
Survival Episode 7 Demographics

Age



Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	4,137	679	16.41%	£0.04	£29.08	0.00	£0.00	0.00%
25 - 34	Campaign ended	4,124	677	16.42%	£0.04	£28.11	0.00	£0.00	0.00%
35 - 44	Campaign ended	2,295	406	17.69%	£0.04	£15.40	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,202	236	19.63%	£0.03	£7.73	0.00	£0.00	0.00%
55 - 64	Campaign ended	709	151	21.30%	£0.03	£4.37	0.00	£0.00	0.00%
65+	Campaign ended	441	102	23.13%	£0.03	£2.81	0.00	£0.00	0.00%
Unknown	Campaign ended	1,810	226	12.49%	£0.06	£12.57	0.00	£0.00	0.00%
Total: Ages		14,718	2,477	16.83%	£0.04	£100.06	0.00	£0.00	0.00%

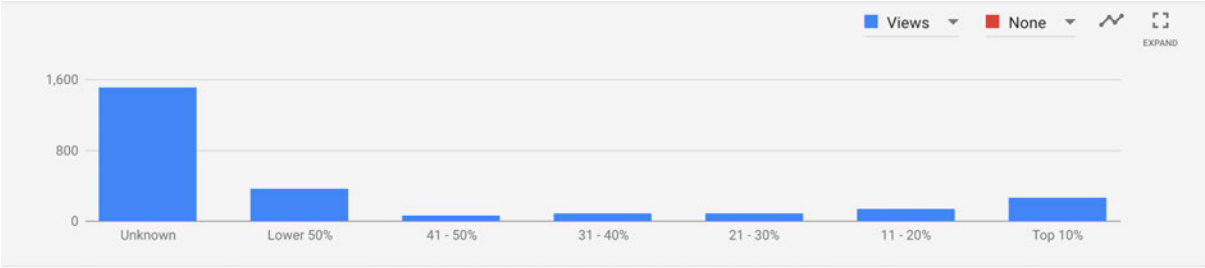
Gender



ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

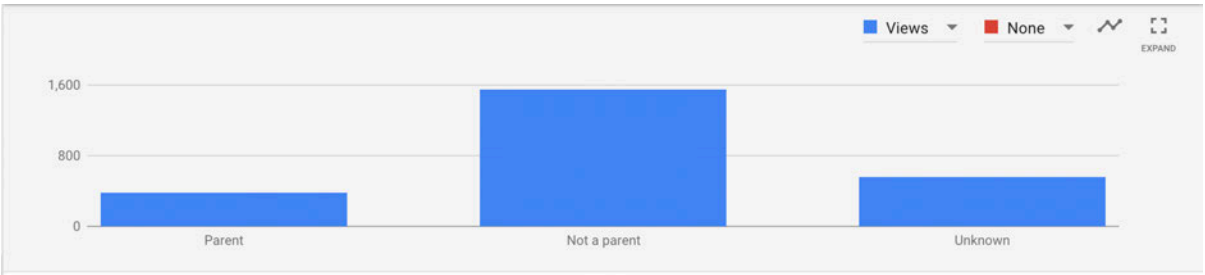
Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	4,908	844	17.20%	£0.04	£33.33	0.00	£0.00	0.00%
Male	Campaign ended	8,791	1,474	16.77%	£0.04	£59.87	0.00	£0.00	0.00%
Unknown	Campaign ended	1,019	159	15.60%	£0.04	£6.86	0.00	£0.00	0.00%
Total: Gende...		14,718	2,477	16.83%	£0.04	£100.06	0.00	£0.00	0.00%

Household Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	1,814	254	14.00%	£0.05	£12.74	0.00	£0.00	0.00%
11 - 20%	Campaign ended	963	130	13.50%	£0.05	£6.80	0.00	£0.00	0.00%
21 - 30%	Campaign ended	613	83	13.54%	£0.05	£4.35	0.00	£0.00	0.00%
31 - 40%	Campaign ended	601	88	14.64%	£0.05	£4.24	0.00	£0.00	0.00%
41 - 50%	Campaign ended	359	53	14.76%	£0.05	£2.49	0.00	£0.00	0.00%
Lower 50%	Campaign ended	1,932	368	19.05%	£0.04	£13.97	0.00	£0.00	0.00%
Unknown	Campaign ended	8,436	1,501	17.79%	£0.04	£55.46	0.00	£0.00	0.00%
Total: Hous...		14,718	2,477	16.83%	£0.04	£100.06	0.00	£0.00	0.00%

Parental Status

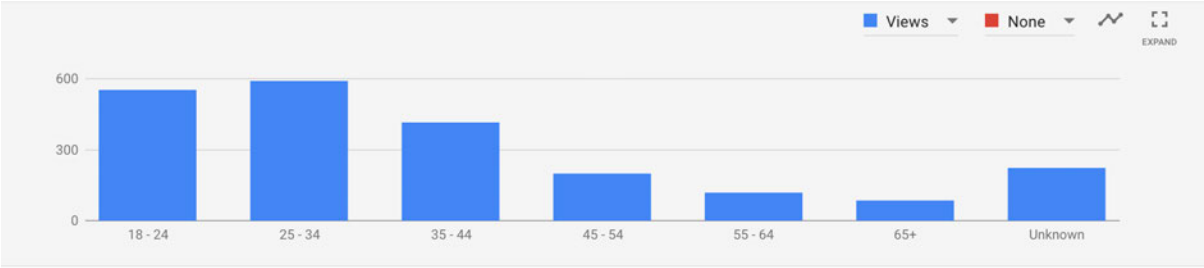


ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	9,910	1,546	15.60%	£0.04	£68.66	0.00	£0.00	0.00%
Parent	Campaign ended	2,201	378	17.17%	£0.04	£14.80	0.00	£0.00	0.00%
Unknown	Campaign ended	2,607	553	21.21%	£0.03	£16.60	0.00	£0.00	0.00%
Total: Paren...		14,718	2,477	16.83%	£0.04	£100.06	0.00	£0.00	0.00%

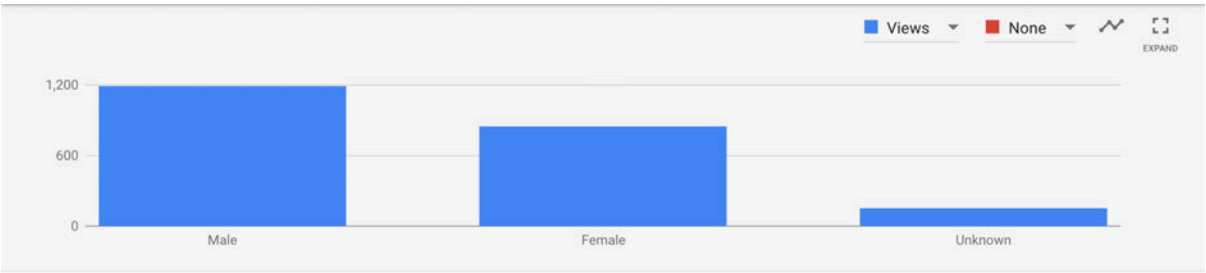
Survival Episode 8 Demographics

Age



Age	Ad group	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	SURVIVAL 8 2019	Campaign ended	3,883	550	14.16%	£0.05	£28.14	0.00	£0.00	0.00%
25 - 34	SURVIVAL 8 2019	Campaign ended	3,687	590	16.00%	£0.04	£26.31	0.00	£0.00	0.00%
35 - 44	SURVIVAL 8 2019	Campaign ended	2,422	413	17.05%	£0.04	£17.01	0.00	£0.00	0.00%
45 - 54	SURVIVAL 8 2019	Campaign ended	1,227	197	16.06%	£0.04	£8.74	0.00	£0.00	0.00%
55 - 64	SURVIVAL 8 2019	Campaign ended	668	115	17.22%	£0.04	£4.66	0.00	£0.00	0.00%
65+	SURVIVAL 8 2019	Campaign ended	394	84	21.32%	£0.03	£2.76	0.00	£0.00	0.00%
Unknown	SURVIVAL 8 2019	Campaign ended	1,703	222	13.04%	£0.06	£12.43	0.00	£0.00	0.00%
Total: Ages			13,984	2,171	15.52%	£0.05	£100.06	0.00	£0.00	0.00%

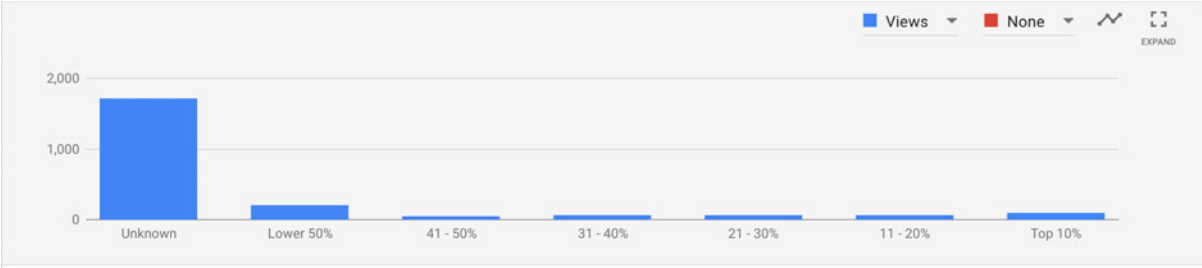
Gender



ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

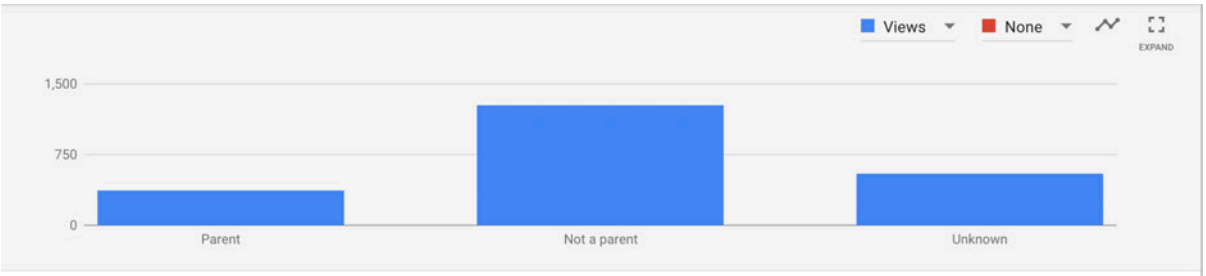
Gender	Ad group	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	SURVIVAL 8 2019	Campaign ended	5,170	841	16.27%	£0.04	£36.74	0.00	£0.00	0.00%
Male	SURVIVAL 8 2019	Campaign ended	7,813	1,184	15.15%	£0.05	£56.06	0.00	£0.00	0.00%
Unknown	SURVIVAL 8 2019	Campaign ended	1,001	146	14.59%	£0.05	£7.26	0.00	£0.00	0.00%
Total: Gen...			13,984	2,171	15.52%	£0.05	£100.06	0.00	£0.00	0.00%

Household Income



Household income	Ad group	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	SURVIVAL 8 2019	Campaign ended	731	86	11.76%	£0.06	£5.44	0.00	£0.00	0.00%
11 - 20%	SURVIVAL 8 2019	Campaign ended	485	57	11.75%	£0.06	£3.59	0.00	£0.00	0.00%
21 - 30%	SURVIVAL 8 2019	Campaign ended	351	48	13.68%	£0.05	£2.60	0.00	£0.00	0.00%
31 - 40%	SURVIVAL 8 2019	Campaign ended	271	50	18.45%	£0.04	£2.00	0.00	£0.00	0.00%
41 - 50%	SURVIVAL 8 2019	Campaign ended	221	39	17.65%	£0.04	£1.58	0.00	£0.00	0.00%
Lower 50%	SURVIVAL 8 2019	Campaign ended	1,105	191	17.29%	£0.04	£8.48	0.00	£0.00	0.00%
Unknown	SURVIVAL 8 2019	Campaign ended	10,820	1,700	15.71%	£0.04	£76.37	0.00	£0.00	0.00%
Total: Hou...			13,984	2,171	15.52%	£0.05	£100.06	0.00	£0.00	0.00%

Parental Status

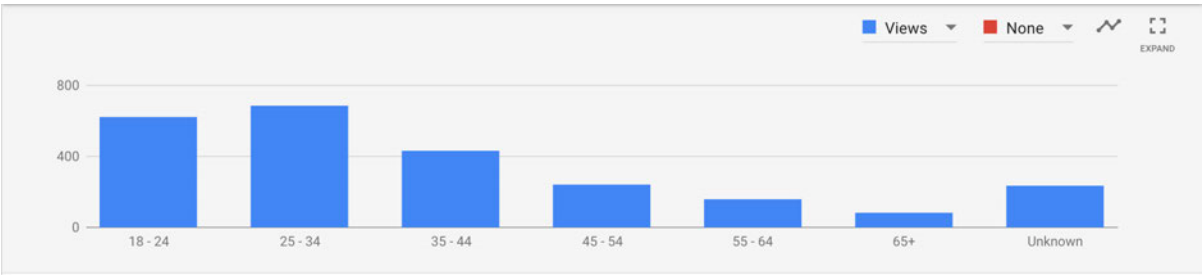


ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

Parental status	Ad group	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Con
Not a parent	SURVIVAL 8 2019	Campaign ended	9,300	1,264	13.59%	£0.05	£67.80	0.00	£0.00	
Parent	SURVIVAL 8 2019	Campaign ended	2,256	365	16.18%	£0.04	£15.94	0.00	£0.00	
Unknown	SURVIVAL 8 2019	Campaign ended	2,428	542	22.32%	£0.03	£16.32	0.00	£0.00	
Total: Pare...			13,984	2,171	15.52%	£0.05	£100.06	0.00	£0.00	

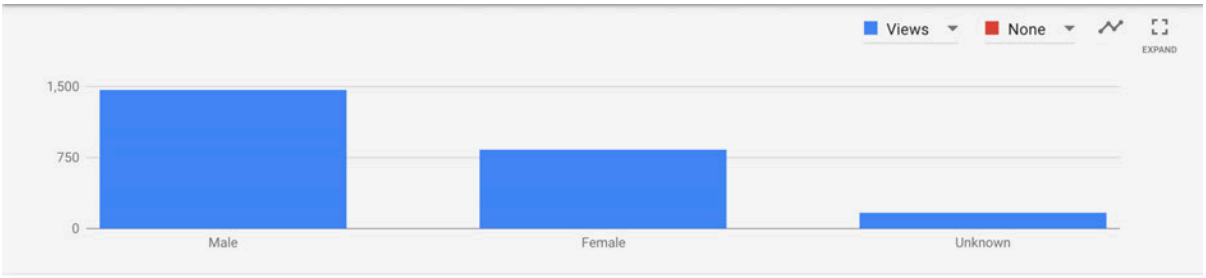
Survival Episode 9 Demographics

Age



Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	4,789	618	12.90%	£0.06	£34.37	0.00	£0.00	0.00%
25 - 34	Campaign ended	4,437	681	15.35%	£0.05	£31.00	0.00	£0.00	0.00%
35 - 44	Campaign ended	2,590	430	16.60%	£0.04	£17.59	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,380	240	17.39%	£0.04	£9.24	0.00	£0.00	0.00%
55 - 64	Campaign ended	811	157	19.36%	£0.03	£5.24	0.00	£0.00	0.00%
65+	Campaign ended	536	81	15.11%	£0.04	£3.48	0.00	£0.00	0.00%
Unknown	Campaign ended	1,956	232	11.86%	£0.06	£14.00	0.00	£0.00	0.00%
Total: Ages		16,499	2,439	14.78%	£0.05	£114.91	0.00	£0.00	0.00%

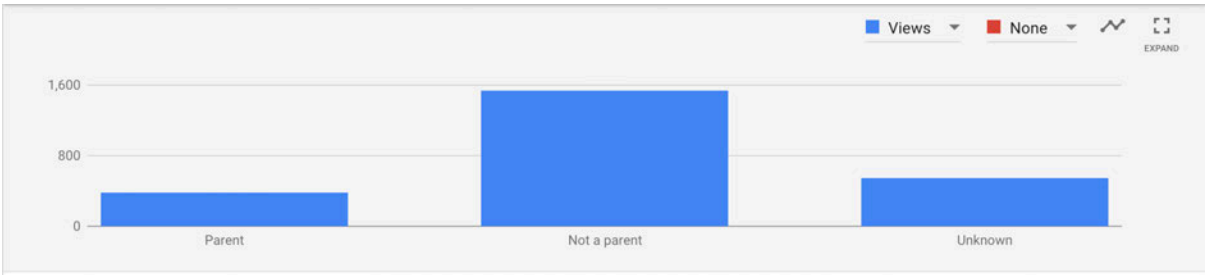
Gender



ADD FILTER Ad group view SEGMENT COLUMNS DOWNLOAD EXPAND

Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	5,344	828	15.49%	£0.04	£37.04	0.00	£0.00	0.00%
Male	Campaign ended	10,151	1,455	14.33%	£0.05	£70.72	0.00	£0.00	0.00%
Unknown	Campaign ended	1,004	156	15.54%	£0.05	£7.16	0.00	£0.00	0.00%
Total: Gende...		16,499	2,439	14.78%	£0.05	£114.91	0.00	£0.00	0.00%

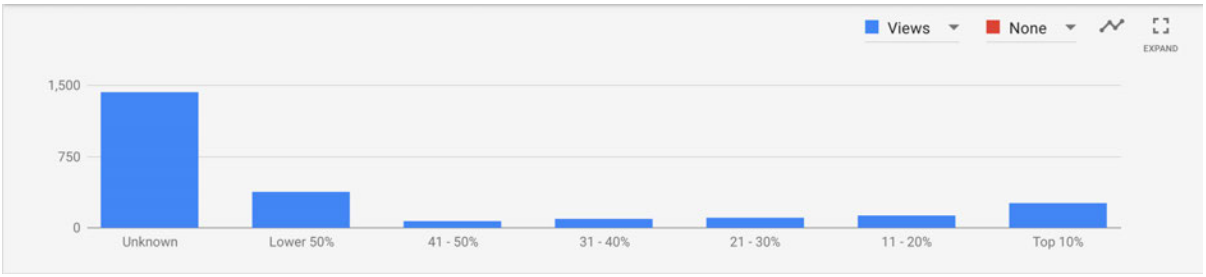
Parental Status



ADD FILTER | Ad group view | SEGMENT | COLUMNS | DOWNLOAD | EXPAND

Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	11,716	1,529	13.05%	£0.05	£82.90	0.00	£0.00	0.00%
Parent	Campaign ended	2,161	372	17.21%	£0.04	£14.81	0.00	£0.00	0.00%
Unknown	Campaign ended	2,622	538	20.52%	£0.03	£17.19	0.00	£0.00	0.00%
Total: Paren...		16,499	2,439	14.78%	£0.05	£114.91	0.00	£0.00	0.00%

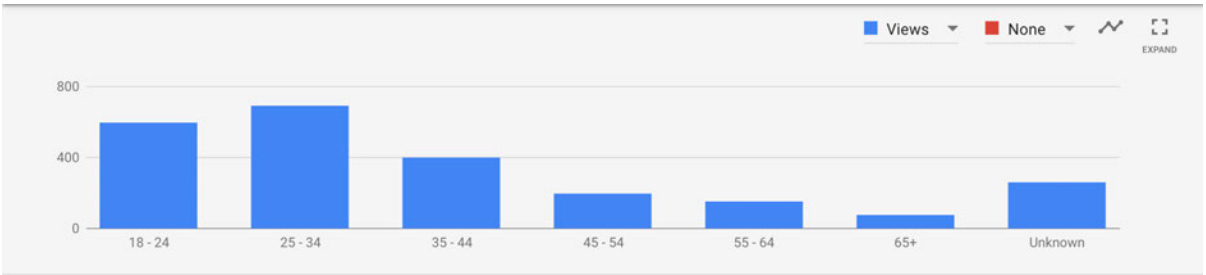
Household Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	2,096	256	12.21%	£0.06	£15.55	0.00	£0.00	0.00%
11 - 20%	Campaign ended	1,229	128	10.41%	£0.07	£8.95	0.00	£0.00	0.00%
21 - 30%	Campaign ended	825	97	11.76%	£0.06	£6.03	0.00	£0.00	0.00%
31 - 40%	Campaign ended	693	91	13.13%	£0.05	£4.95	0.00	£0.00	0.00%
41 - 50%	Campaign ended	491	63	12.83%	£0.06	£3.62	0.00	£0.00	0.00%
Lower 50%	Campaign ended	2,466	379	15.37%	£0.05	£18.55	0.00	£0.00	0.00%
Unknown	Campaign ended	8,699	1,425	16.38%	£0.04	£57.26	0.00	£0.00	0.00%
Total: Hous...		16,499	2,439	14.78%	£0.05	£114.91	0.00	£0.00	0.00%
Total: Other		0	0	–	–	£0.00	–	–	–

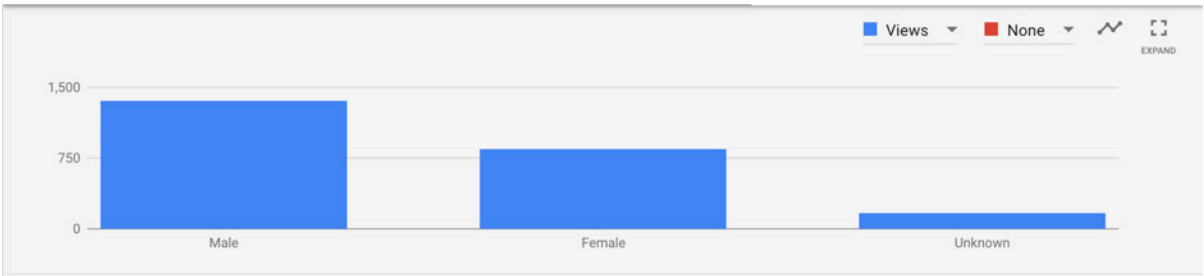
Survival Episode 10 Demographics

Age



Age	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
18 - 24	Campaign ended	4,067	596	14.65%	£0.05	£28.43	0.00	£0.00	0.00%
25 - 34	Campaign ended	4,128	688	16.67%	£0.04	£27.93	0.00	£0.00	0.00%
35 - 44	Campaign ended	2,463	394	16.00%	£0.04	£16.84	0.00	£0.00	0.00%
45 - 54	Campaign ended	1,143	191	16.71%	£0.04	£7.37	0.00	£0.00	0.00%
55 - 64	Campaign ended	707	150	21.22%	£0.03	£4.49	0.00	£0.00	0.00%
65+	Campaign ended	396	75	18.94%	£0.03	£2.50	0.00	£0.00	0.00%
Unknown	Campaign ended	1,797	257	14.30%	£0.05	£12.53	0.00	£0.00	0.00%
Total: Ages		14,701	2,351	15.99%	£0.04	£100.10	0.00	£0.00	0.00%

Gender



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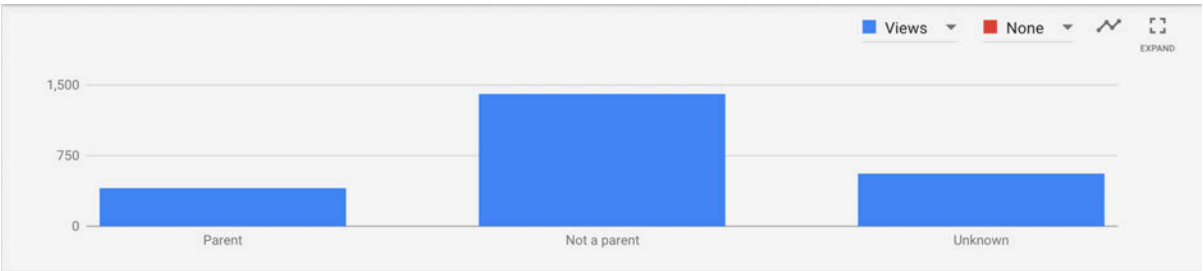
Gender	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Female	Campaign ended	5,189	839	16.17%	£0.04	£34.96	0.00	£0.00	0.00%
Male	Campaign ended	8,528	1,347	15.80%	£0.04	£58.56	0.00	£0.00	0.00%
Unknown	Campaign ended	984	165	16.77%	£0.04	£6.58	0.00	£0.00	0.00%
Total: Gende...		14,701	2,351	15.99%	£0.04	£100.10	0.00	£0.00	0.00%

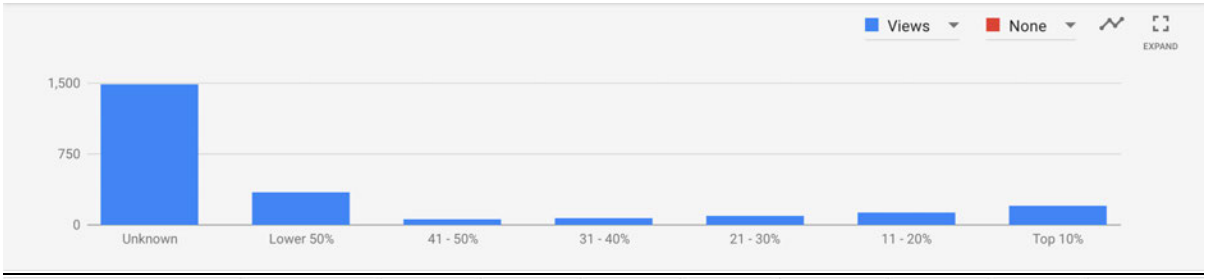
Parental Status



ADD FILTER | Ad group view | SEGMENT | COLUMNS | DOWNLOAD | EXPAND

Parental status	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Not a parent	Campaign ended	9,693	1,396	14.40%	£0.05	£67.38	0.00	£0.00	0.00%
Parent	Campaign ended	2,431	397	16.33%	£0.04	£16.13	0.00	£0.00	0.00%
Unknown	Campaign ended	2,577	558	21.65%	£0.03	£16.59	0.00	£0.00	0.00%
Total: Paren...		14,701	2,351	15.99%	£0.04	£100.10	0.00	£0.00	0.00%

Household Income



Household income	Status	Impr.	Views	View rate	Avg. CPV	Cost	Conversions	Cost / conv.	Conv. rate
Top 10%	Campaign ended	1,643	194	11.81%	£0.06	£11.71	0.00	£0.00	0.00%
11 - 20%	Campaign ended	946	120	12.68%	£0.06	£6.67	0.00	£0.00	0.00%
21 - 30%	Campaign ended	668	90	13.47%	£0.05	£4.85	0.00	£0.00	0.00%
31 - 40%	Campaign ended	498	67	13.45%	£0.05	£3.62	0.00	£0.00	0.00%
41 - 50%	Campaign ended	386	54	13.99%	£0.05	£2.78	0.00	£0.00	0.00%
Lower 50%	Campaign ended	1,876	338	18.02%	£0.04	£13.69	0.00	£0.00	0.00%
Unknown	Campaign ended	8,684	1,488	17.13%	£0.04	£56.77	0.00	£0.00	0.00%
Total: Hous...		14,701	2,351	15.99%	£0.04	£100.10	0.00	£0.00	0.00%

Appendix 2.
Analytics of the viewership of each of the 10 episodes on Croatian National Television's Programme 1 from 19 Sep 2018 to 24 Oct 2018.

Table S1: Daily statistics for all programmes on Croatian television on 19 Sep 2018 that were viewed by at least 1% of total population.

Channel	Description	Start time	% total population	% active viewers	Number of viewers
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	20:19	15,2%	37,2%	595.483
NovaTV	DNEVNIK NOVA TV	19:15	12,0%	37,6%	469.400
NovaTV	FARMA - DNEVNA EMISIJA	21:29	11,3%	28,4%	443.897
HTV2	NOGOMET - REAL MADRID - ROMA - 1/2	21:00	8,2%	19,4%	321.735
HTV2	NOGOMET - REAL MADRID - ROMA - 2/2	22:03	7,6%	21,5%	300.141
HTV2	NOGOMET - REAL MADRID - ROMA - PRIJENOS	20:59	7,6%	19,6%	300.047
HTV1	VREMENSKA PROGNOZA HRT1	19:46	7,1%	21,7%	276.761
HTV1	DNEVNIK U PODNE	12:00	6,8%	42,9%	266.267
NovaTV	VIJESTI NOVA TV	17:00	6,7%	33,7%	262.162
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA U PODNE	12:14	6,5%	41,8%	256.518
HTV1	VRIJEME DANAS HTV	12:17	6,5%	40,9%	253.618
NovaTV	KAZNA - TURSKA DRAMSKA SERIJA	22:30	6,3%	22,7%	248.597
HTV1	DNEVNIK U 19H	19:00	6,3%	22,8%	247.317
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA	21:51	6,2%	15,1%	241.671
RTL	ZIVOT NA VAGI - REALITY SHOW	20:57	6,1%	14,8%	240.381
NovaTV	IN MAGAZIN	17:31	6,0%	29,4%	234.459
RTL	RTL DANAS (RTL DANAS)	18:29	5,9%	25,0%	232.955
RTL	NAJAVA RTL DIREKT	22:14	5,9%	15,8%	232.943
NovaTV	NAJAVA DNEVNIK NOVA TV	19:14	5,9%	22,5%	229.608
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	18:22	5,7%	24,6%	223.943
HTV1	TEMA DANA - INFORMATIVNA EMISIJA	19:49	5,7%	17,2%	223.834
RTL	RTL DIREKT	22:15	5,6%	16,1%	221.593
NovaTV	NAJAVA VIJESTI NOVA TV	23:30	5,3%	25,8%	208.782
HTV1	SAT PRIJE DNEVNIKA U PODNE	11:59	5,2%	34,9%	205.143
RTL	RTL DANAS	18:29	5,0%	18,7%	198.055
NovaTV	NAJAVA VIJESTI NOVA TV	16:59	5,0%	25,4%	194.230
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	20:00	4,7%	12,4%	186.145
RTL	RTL DANAS (RTL DANAS)	19:53	4,7%	14,1%	185.044
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA I SAZECI	22:55	4,5%	19,6%	177.849

HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA	20:35	4,5%	11,1%	175.955
RTL	RTL DANAS (POTRAGA)	19:17	4,5%	16,2%	175.902
NovaTV	FARMA - DNEVNA EMISIJA	15:52	4,2%	21,7%	163.674
HTV1	VREMENSKA PROGNOZA HRT1	18:58	4,2%	17,2%	163.019
HTV1	SAT PRIJE DNEVNIKA U 19H	18:59	4,1%	17,1%	161.311
RTL	RTL DANAS (RTL DANAS)	19:33	4,1%	13,9%	160.543
RTL	NAJAVA RTL DANAS	18:29	4,0%	18,6%	157.122
RTL	RTL DANAS (VRIJEME)	19:29	4,0%	13,9%	156.807
NovaTV	VIJESTI NOVA TV	23:31	3,9%	22,6%	154.752
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	14:51	3,9%	22,3%	154.124
RTL	RTL DANAS (SPORT)	19:41	3,9%	12,1%	153.587
NovaTV	VIJESTI NOVA TV	14:00	3,8%	22,1%	147.870
HTV1	POTJERA - TV KVIZ	18:11	3,7%	16,7%	143.706
HTV1	SPONE LJUBAVI - BRAZILSKA TELENOVELA	12:27	3,6%	21,8%	139.329
HTV1	DNEVNIK 3	22:51	3,5%	12,7%	136.797
HTV1	HRVATSKA LUTRIJA - IZVLACENJE BROJEVA LOTA	19:59	3,4%	9,9%	133.614
RTL	RTL VIJESTI	16:30	3,4%	17,7%	133.289
Doma TV	UBOJSTVO PRVOG STUPNJA - AMERICKA KRIMINALISTICKA SERIJA	21:21	3,4%	8,1%	133.087
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	11:42	3,3%	25,5%	130.906
Doma TV	NAVY CIS - AMERICKA KRIMINALISTICKA SERIJA	20:29	3,3%	8,1%	130.331
Doma TV	UBOJSTVO PRVOG STUPNJA - AMERICKA KRIMINALISTICKA SERIJA	22:06	3,3%	9,4%	128.422
HTV1	DOBRO JUTRO HRVATSKA	6:54	3,2%	43,3%	127.030
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	14:11	3,2%	18,6%	124.040
NovaTV	NAJAVA VIJESTI NOVA TV	13:59	3,1%	18,0%	120.880
HTV2	RUKOMET - LIGA PRVAKA (M) - PRIJENOS - 2/2	19:55	3,0%	8,3%	117.804
RTL	ZIVOT NA VAGI - REALITY SHOW	16:59	2,7%	13,5%	106.295
RTL	ZIVOT NA VAGI: LATE NIGHT	23:00	2,7%	10,7%	106.245
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA 3	23:06	2,6%	10,1%	101.308
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:07	2,6%	6,1%	100.886
RTL	NAJAVA RTL VIJESTI	16:29	2,5%	13,0%	98.981
HTV1	BANKARSKI KRIMINAL - DOKUMENTARNI FILM	20:05	2,5%	6,5%	98.858

NovaTV	NAD LIPOM 35	12:54	2,5%	14,8%	97.419
HTV1	OTVORENO - POLITICKI TALK SHOW	22:00	2,5%	6,8%	96.930
HTV1	VETERINAR ENGEL - NJEMACKA SERIJA	10:21	2,5%	22,0%	96.189
HTV1	VIJESTI U 5	16:59	2,4%	12,4%	95.969
Doma TV	LUCIFER - AMERICKA KRIMINALISTICKA SERIJA	22:54	2,3%	10,2%	91.528
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:16	2,3%	5,4%	90.555
HTV2	REGIONALNI DNEVNIK	16:00	2,3%	11,9%	89.772
HTV1	VRIJEME SUTRA HTV	17:15	2,3%	11,4%	89.568
HTV2	SVJEDOKINJA - AMERICKI TRILER	13:28	2,3%	13,3%	88.495
HTV1	HRVATSKA LUTRIJA - REZULTAT IZVLACENJA LOTA	21:03	2,3%	5,4%	88.292
HTV1	POLA URE KULTURE - KULTURNO OBRAZOVNA EMISIJA	21:24	2,1%	5,0%	81.905
HTV1	BONTON	11:35	2,1%	17,0%	80.736
HTV1	EKO ZONA - EMISIJA O EKOLOGIJI	11:09	2,0%	17,3%	79.472
RTL	ZIVOT NA VAGI - REALITY SHOW	16:24	2,0%	10,5%	79.190
HTV1	VRIJEME SUTRA HTV	23:13	2,0%	8,2%	78.721
Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	19:40	2,0%	5,7%	77.946
HTV1	HAK: PROMET INFO	17:16	1,9%	9,6%	75.037
NovaTV	IN MAGAZIN	12:02	1,9%	11,9%	74.484
HTV1	DR. OZ - TALK SHOW	13:19	1,9%	11,2%	73.889
NovaTV	KAZNA - TURSKA DRAMSKA SERIJA	10:01	1,9%	17,5%	73.509
HTV2	RUKOMET - LIGA PRVAKA (M) - PRIJENOS	18:54	1,9%	5,9%	72.930
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	16:44	1,9%	9,5%	72.915
HTV1	SAT PRIJE DNEVNIKA 3	22:50	1,9%	6,1%	72.648
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:52	1,8%	4,6%	71.402
HTV1	VIJESTI IZ KULTURE	23:16	1,7%	7,5%	67.869
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:10	1,7%	4,7%	67.211
HTV2	SVJEDOKINJA - AMERICKI TRILER	23:44	1,7%	14,9%	66.456
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	11:05	1,7%	13,2%	64.962
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	15:24	1,6%	8,8%	64.352
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	13:08	1,6%	9,5%	63.328
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	6:35	1,6%	40,6%	62.602
RTL Kockica	A JE TO - ANIMIRANI FILM	19:39	1,6%	5,0%	62.394

RTL 2	KRV NIJE VODA - HRVATSKA DOKUMENTARNA DRAMA	11:52	1,5%	9,9%	60.624
HTV2	SVIJET VRTLARA - DOKUMENTARNA SERIJA	12:53	1,5%	9,2%	60.513
HTV2	ZEMLJA LEDENJAKA - DOKUMENTARNI FILM	14:58	1,5%	8,7%	60.144
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:29	1,5%	3,6%	58.876
HTV4	VIJESTI HRT4	14:59	1,5%	8,9%	58.662
HTV2	U ISTOM LONCU - KULINARSKI SHOW	17:36	1,5%	7,3%	58.506
HTV4	BEZ KOMENTARA	14:57	1,5%	8,9%	58.385
HTV4	VRIJEME DANAS RH	15:09	1,5%	8,5%	58.220
RTL Kockica	A JE TO - ANIMIRANI FILM	19:31	1,5%	4,9%	57.575
HTV4	STUDIO 4 - STUDIO	14:39	1,5%	8,6%	57.511
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	17:10	1,5%	7,3%	57.493
RTL	HORVATOVI - HRVATSKA OBITELJSKA DRAMSKA SERIJA	14:27	1,5%	8,5%	57.156
RTL Kockica	A JE TO - ANIMIRANI FILM	19:47	1,4%	4,4%	56.129
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:24	1,4%	5,0%	55.422
HTV1	GRANTCHESTER - BRITANSKA DRAMSKA SERIJA	15:55	1,4%	7,3%	54.651
RTL	CSI: LAS VEGAS - AMERICKA KRIMINALISTICKA SERIJA	23:19	1,4%	8,2%	54.064
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:17	1,4%	5,1%	53.763
HTV1	BEZ RACUNA SE NE RACUNA - IZVLACENJE NAGRADA	15:40	1,4%	7,4%	53.062
HTV4	BEZ KOMENTARA	15:23	1,3%	7,5%	52.403
HTV1	POGLED PREKO GRANICE - HRVATI U BIH	14:30	1,3%	7,8%	52.198
HTV1	POTROSACKI KOD - INFORMATIVNA EMISIJA	14:03	1,3%	7,8%	51.742
HTV4	STUDIO 4 - STUDIO	15:10	1,3%	7,5%	51.720
HTV2	ODMORI SE, ZASLUZIO SI - HRVATSKA HUMORISTICNA SERIJA	18:21	1,3%	5,9%	51.191
HTV2	ODJEK DINOSAURA - DOKUMENTARNI FILM	16:43	1,3%	6,6%	50.771
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	16:25	1,3%	6,6%	50.693
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:30	1,3%	3,9%	50.430
HTV4	STUDIO 4 - STUDIO	15:24	1,3%	7,2%	49.758
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	12:41	1,3%	7,7%	49.216
RTL 2	CSI: MIAMI - AMERICKA KRIMINALISTICKA SERIJA	15:20	1,2%	6,7%	48.614
HTV4	POSLOVNE VIJESTI	14:33	1,2%	7,2%	48.307
HTV2	SICILIJA S ALDOM I ENZOM - DOKUMENTARNA SERIJA	12:23	1,2%	7,7%	48.043
RTL Kockica	DOKTORICA PLISKO - ANIMIRANA SERIJA	11:02	1,2%	10,7%	48.001
NovaTV	NEMA REZERVACIJA - AMERICKO AUSTRALSKA KOMEDIJA	23:55	1,2%	13,4%	47.922

RTL 2	MODERNA OBITELJ - AMERICKA HUMORISTICNA SERIJA	23:50	1,2%	9,1%	47.662
HTV4	ZASJEDANJE HRVATSKOG SABORA - PRIJENOS	9:33	1,2%	8,8%	47.640
Doma TV	DJEVOJKE NA ZADATKU - AMERICKA KRIMINALISTICKA SERIJA	15:35	1,2%	6,4%	47.397
HTV1	KOD NAS DOMA - MOZAICNA EMISIJA	17:21	1,2%	6,0%	47.372
RTL Kockica	JAN I PIRATI IZ NIGDJEZEMSKE - ANIMIRANA SERIJA	10:36	1,2%	10,5%	46.786
HTV2	RUKOMET - LIGA PRVAKA (M) - PRIJENOS - 1/2	19:01	1,2%	4,3%	45.944
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:10	1,2%	4,5%	45.912
RTL Kockica	BEN 10 - AMERICKA ANIMIRANA SERIJA	14:20	1,1%	6,7%	44.380
RTL 2	MONK - AMERICKA KRIMINALISTICKA SERIJA	20:35	1,1%	2,7%	44.055
RTL Kockica	MALI EINSTEINI - AMERICKA ANIMIRANA SERIJA	10:11	1,1%	10,7%	43.872
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:21	1,1%	5,9%	43.752
HTV1	DOBAR DAN, HRVATSKA	15:00	1,1%	6,3%	43.613
RTL Kockica	KUNG FU PANDA - AMERICKA ANIMIRANA SERIJA	16:15	1,1%	5,7%	43.263
RTL 2	MODERNA OBITELJ - AMERICKA HUMORISTICNA SERIJA	0:17	1,1%	10,3%	42.636
HTV4	BEZ KOMENTARA	14:38	1,1%	6,4%	42.449
HTV2	GLAZBENI SPOTOVI	19:42	1,1%	3,3%	42.160
HTV4	VIJESTI HRT4	15:24	1,1%	6,0%	41.783
RTL Kockica	LUNA PETUNIA - AMERICKA ANIMIRANA SERIJA	14:48	1,1%	6,2%	41.570
RTL Kockica	SOY LUNA - ARGETINSKA SERIJA ZA MLADE	11:27	1,1%	7,8%	41.544
RTL 2	SUDNICA - SHOW	10:55	1,1%	8,8%	41.335
RTL 2	CSI: MIAMI - AMERICKA KRIMINALISTICKA SERIJA	14:24	1,1%	6,1%	41.049
Doma TV	ARROW - AMERICKA AKCIJSKA SERIJA	23:44	1,0%	8,2%	40.797
HTV3	MIRIS BARUTA - AMERICKA SERIJA	13:30	1,0%	6,2%	40.791
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:01	1,0%	4,1%	40.481
HTV4	STUDIO 4	7:59	1,0%	8,0%	40.349
RTL Kockica	SKITALICA - PITALICA	14:33	1,0%	6,0%	40.335
RTL Kockica	MALI IZVIDACI - ZABAVNO EDUKATIVNA EMISIJA	16:40	1,0%	5,3%	40.288
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	16:15	1,0%	5,2%	40.063
RTL	CSI: LAS VEGAS - AMERICKA KRIMINALISTICKA SERIJA	0:14	1,0%	10,4%	40.026
RTL Kockica	MIRACULOUS: PUSTOLOVINE BUBAMARE I CRNOG MACKA - ANIMI. SERIJA	15:27	1,0%	5,6%	39.973
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	19:49	1,0%	2,8%	39.937

RTL Kockica	A JE TO - ANIMIRANI FILM	12:39	1,0%	6,3%	39.803
HTV1	GRANTCHESTER - BRITANSKA DRAMSKA SERIJA	23:47	1,0%	8,0%	39.732
RTL Kockica	ZAK STORM - FRANCUSKA ANIMIRANA SERIJA	13:19	1,0%	6,0%	39.432
Doma TV	MUSKARAC, ZENA I DIVLJINA - REALITY SERIJA	17:58	1,0%	4,6%	39.137
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:34	1,0%	4,9%	39.097
RTL Kockica	LUNA PETUNIA - AMERICKA ANIMIRANA SERIJA	14:37	1,0%	5,8%	38.737
RTL	SHOPPING KRALJICA - LIFESTYLE EMISIJA	13:15	1,0%	5,8%	38.378
Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	14:01	1,0%	5,7%	38.375
HTV4	BEZ KOMENTARA	15:58	1,0%	5,2%	38.374
HTV1	BROOKLYN 99 - AMERICKA HUMORISTICNA SERIJA	23:26	1,0%	5,2%	38.296
RTL Kockica	IDEMO U ZOO - ZABAVNO EDUKATIVNA EMISIJA	14:59	1,0%	5,7%	38.007
RTL 2	MIKE I MOLLY - AMERICKA HUMORISTICNA SERIJA	0:44	1,0%	11,2%	37.990
Doma TV	CSI: LAS VEGAS - AMERICKA KRIMINALISTICKA SERIJA	13:15	1,0%	5,6%	37.310

Table S2: Daily statistics for all programmes on Croatian television on 26 Sep 2018 that were viewed by at least 1% of total population.

Channel	Description	Start time	% total population	% active viewers	Number of viewers
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	20:20	17,5%	41,7%	689.051
NovaTV	DNEVNIK NOVA TV	19:15	15,7%	42,1%	615.543
NovaTV	FARMA - DNEVNA EMISIJA	21:27	12,9%	33,1%	504.593
NovaTV	NAJAVA DNEVNIK NOVA TV	19:14	8,4%	25,8%	331.574
RTL	NAJAVA RTL DIREKT	22:14	8,1%	22,0%	318.542
NovaTV	KAZNA - TURSKA DRAMSKA SERIJA	22:25	7,7%	27,3%	302.467
RTL	ZIVOT NA VAGI - REALITY SHOW	21:04	7,6%	18,9%	299.874
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA U PODNE	12:15	7,4%	49,5%	289.758
HTV1	DNEVNIK U PODNE	12:00	7,3%	49,9%	287.554
RTL	RTL DIREKT	22:15	7,2%	21,0%	284.344
HTV1	VRIJEME DANAS HTV	12:18	7,2%	48,2%	281.594
RTL	RTL DANAS (POTRAGA)	19:26	7,1%	20,0%	280.619
HTV1	DNEVNIK U 19H	19:00	7,1%	20,9%	278.023
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	18:22	7,0%	24,6%	276.630
HTV1	VREMENSKA PROGNOZA HRT1	19:46	6,9%	18,1%	269.211
NovaTV	VIJESTI NOVA TV	17:00	6,8%	31,7%	266.765
RTL	RTL DANAS (VRIJEME)	19:37	6,7%	18,1%	262.221
NovaTV	NAJAVA VIJESTI NOVA TV	23:31	6,6%	31,7%	260.264
RTL	RTL DANAS (RTL DANAS)	18:30	6,5%	21,4%	254.335
NovaTV	IN MAGAZIN	17:31	6,3%	27,7%	248.888
RTL	RTL DANAS (RTL DANAS)	19:40	6,3%	17,1%	247.921
RTL	RTL DANAS	18:30	6,2%	18,9%	244.543
HTV1	SAT PRIJE DNEVNIKA U 19H	18:59	6,0%	20,1%	236.563
HTV1	VREMENSKA PROGNOZA HRT1	18:58	6,0%	20,0%	234.229
NovaTV	NAJAVA VIJESTI NOVA TV	16:59	5,7%	27,6%	223.795
RTL	RTL DANAS (RTL DANAS)	19:59	5,5%	14,1%	216.909
RTL	RTL DANAS (SPORT)	19:48	5,0%	12,9%	194.658
HTV1	TEMA DANA - INFORMATIVNA EMISIJA	19:49	4,9%	12,8%	193.350
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	20:04	4,9%	11,8%	190.729

HTV1	SAT PRIJE DNEVNIKA U PODNE	11:59	4,8%	35,7%	188.964
HTV1	POTJERA - TV KVIZ	18:08	4,6%	17,4%	181.335
NovaTV	VIJESTI NOVA TV	23:31	4,2%	24,1%	165.038
RTL	ZIVOT NA VAGI - REALITY SHOW	22:55	4,1%	14,4%	160.435
HTV1	DOBRO JUTRO HRVATSKA	6:54	4,1%	48,5%	160.103
HTV1	DNEVNIK 3	22:55	3,9%	14,0%	152.202
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	15:59	3,8%	19,7%	150.456
Doma TV	NAVY CIS - AMERICKA KRIMINALISTICKA SERIJA	20:30	3,7%	8,7%	144.333
RTL	NAJAVA RTL DANAS	18:29	3,6%	14,2%	142.621
HTV1	SAT PRIJE DNEVNIKA 3	22:54	3,6%	12,3%	139.489
RTL	RTL VIJESTI	16:30	3,5%	17,6%	137.736
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	22:12	3,4%	10,5%	134.410
NovaTV	FARMA - DNEVNA EMISIJA	14:48	3,3%	20,2%	131.357
RTL	ZIVOT NA VAGI: LATE NIGHT	23:03	3,3%	13,3%	130.797
Doma TV	SEAL TEAM - AMERICKA AKCIJSKA SERIJA	21:21	3,3%	8,4%	130.589
HTV1	HRVATSKA LUTRIJA - IZVLACENJE BROJEVA LOTA	19:59	3,3%	8,4%	129.596
NovaTV	VIJESTI NOVA TV	14:00	3,2%	20,3%	126.360
HTV1	SPONE LJUBAVI - BRAZILSKA TELENOVELA	12:25	3,2%	22,3%	125.671
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA 3	23:09	3,2%	12,4%	125.425
HTV1	OTVORENO - POLITICKI TALK SHOW	22:00	3,1%	8,8%	121.947
RTL	ZIVOT NA VAGI - REALITY SHOW	16:59	3,1%	13,6%	119.825
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	11:42	3,0%	24,3%	119.201
NovaTV	NAJAVA VIJESTI NOVA TV	13:59	3,0%	19,3%	117.297
HTV2	REGIONALNI DNEVNIK	16:00	2,9%	15,4%	115.082
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	14:10	2,9%	18,5%	112.324
Doma TV	LUCIFER - AMERICKA KRIMINALISTICKA SERIJA	23:04	2,8%	13,3%	111.477
Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	19:39	2,7%	6,9%	105.335
HTV1	KRIJUMCARI LJUDI - DOKUMENTARNI FILM	20:05	2,6%	6,3%	101.779
HTV2	CRNO MORE - BRITANSKO AMERICKI TRILER	21:00	2,6%	6,7%	101.132
HTV1	VRIJEME SUTRA HTV	23:14	2,5%	10,1%	99.314
HTV2	DIVLJI NOVI ZELAND - DOKUMENTARNA SERIJA	16:48	2,5%	11,9%	99.136
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:07	2,4%	5,6%	93.505
RTL	HORVATOVI - HRVATSKA OBITELJSKA DRAMSKA SERIJA	14:36	2,3%	14,5%	91.320

NovaTV	NAD LIPOM 35	12:48	2,3%	15,8%	91.265
RTL	NAJAVA RTL VIJESTI	16:29	2,2%	11,1%	85.051
HTV2	OPROSTAJNO PISMO - AMERICKA DRAMA	13:27	2,2%	14,1%	84.844
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:49	2,1%	5,4%	81.274
HTV1	VETERINAR ENGEL - NJEMACKA SERIJA	10:20	2,1%	20,6%	80.859
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	15:31	2,1%	11,5%	80.782
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	16:56	2,1%	10,0%	80.704
HTV2	IZMEDU ZEMLJE I NEBA - DOKUMENTARNA SERIJA	15:02	2,0%	12,2%	79.830
HTV1	VRIJEME SUTRA HTV	17:14	2,0%	9,2%	78.842
HTV1	BONTON	11:34	2,0%	17,4%	78.824
HTV2	DOMOVINA - AMERICKA DRAMSKA SERIJA	22:52	2,0%	8,3%	78.207
HTV1	VIJESTI U 5	16:59	2,0%	9,3%	78.115
NovaTV	DZUNGLA - AUSTRALSKO KOLUMBIJSKA AKCIJSKA DRAMA	23:58	2,0%	22,6%	78.022
HTV2	ODMORI SE, ZASLUZIO SI - HRVATSKA HUMORISTICNA SERIJA	18:23	2,0%	7,2%	77.685
HTV1	HAK: PROMET INFO	17:15	2,0%	9,0%	76.866
HTV1	HRVATSKA LUTRIJA - REZULTAT IZVLACENJA LOTA	21:05	1,9%	4,6%	76.366
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	13:03	1,9%	13,3%	75.842
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:24	1,9%	4,7%	75.038
HTV2	U ISTOM LONCU - KULINARSKI SHOW	17:40	1,9%	8,1%	73.756
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	12:33	1,9%	12,8%	72.534
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	16:44	1,8%	8,7%	68.960
HTV1	VIJESTI IZ KULTURE	23:16	1,7%	7,1%	64.808
RTL	SMRT U RAJU - BRITANSKA KRIMINALISTICKA SERIJA	12:32	1,6%	11,2%	63.799
HTV1	DR. OZ - TALK SHOW	13:16	1,6%	10,9%	63.294
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:29	1,6%	5,0%	63.148
RTL 2	KRV NIJE VODA - HRVATSKA DOKUMENTARNA DRAMA	11:51	1,6%	11,3%	62.558
RTL 2	MONK - AMERICKA KRIMINALISTICKA SERIJA	20:39	1,6%	3,8%	62.449
HTV1	EKO ZONA - EMISIJA O EKOLOGIJI	11:08	1,6%	15,0%	62.247
HTV1	POLA URE KULTURE - KULTURNO OBRAZOVNA EMISIJA	21:24	1,6%	3,9%	61.315
HTV3	NASE MALO MISTO - DRAMSKA SERIJA	20:05	1,6%	3,8%	60.973
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:09	1,5%	4,1%	59.224
HTV1	GRANTCHESTER - BRITANSKA DRAMSKA SERIJA	15:55	1,5%	8,0%	59.185

RTL	ANDRIJA I ANDELKA - SRPSKA HUMORISTICNA SERIJA	23:25	1,5%	8,9%	58.656
HTV2	OBITELJSKI ZLOCINI - DOKUMENTARNA SERIJA	20:05	1,5%	3,6%	56.976
Doma TV	ARROW - AMERICKA AKCIJSKA SERIJA	23:51	1,4%	11,8%	55.499
RTL	SHOPPING KRALJICA - LIFESTYLE EMISIJA	13:38	1,4%	9,0%	54.258
Doma TV	MUSKARAC, ZENA I DIVLJINA - REALITY SERIJA	18:04	1,4%	5,3%	54.243
HTV2	ISTINA ILI MIT	20:51	1,4%	3,2%	53.809
HTV4	VIJESTI HRT4	15:00	1,4%	8,3%	53.310
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	19:50	1,3%	3,4%	52.179
HTV4	VIJESTI HRT4	14:29	1,3%	8,5%	52.077
HTV4	POSLOVNE VIJESTI	14:34	1,3%	8,3%	51.490
NovaTV	IN MAGAZIN	11:54	1,3%	9,1%	51.077
RTL Kockica	A JE TO - ANIMIRANI FILM	19:41	1,3%	3,5%	51.014
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	10:53	1,3%	11,7%	50.378
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:00	1,3%	4,9%	50.337
HTV1	KOD NAS DOMA - MOZAICNA EMISIJA	17:19	1,3%	5,8%	50.163
RTL Kockica	A JE TO - ANIMIRANI FILM	19:48	1,3%	3,3%	49.585
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	6:35	1,3%	32,1%	49.471
HTV4	STUDIO 4 - STUDIO	14:12	1,3%	8,1%	48.933
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:40	1,2%	5,6%	48.816
HTV2	SVIJET VRTLARA - DOKUMENTARNA SERIJA	12:53	1,2%	8,5%	48.131
HTV4	VRIJEME DANAS RH	14:27	1,2%	7,8%	47.331
HTV4	VRIJEME DANAS EU	14:11	1,2%	7,7%	47.199
HTV1	POTROSACKI KOD - INFORMATIVNA EMISIJA	14:00	1,2%	7,7%	47.021
RTL 2	SUDNICA - SHOW	10:55	1,2%	10,9%	46.670
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:06	1,2%	5,4%	46.037
HTV4	VIJESTI HRT4	13:59	1,2%	7,4%	45.905
HTV4	VIJESTI HRT4	18:00	1,1%	4,9%	44.570
RTL 2	DR. HOUSE - AMERICKA DRAMSKA SERIJA	18:57	1,1%	3,4%	44.381
HTV3	MIRIS BARUTA - AMERICKA SERIJA	13:35	1,1%	7,4%	44.286
RTL Kockica	A JE TO - ANIMIRANI FILM	19:34	1,1%	3,1%	44.112
HTV4	BEZ KOMENTARA	14:58	1,1%	7,0%	44.016
RTL Kockica	KUNG FU PANDA - AMERICKA ANIMIRANA SERIJA	16:19	1,1%	5,7%	43.944
HTV4	VRIJEME DANAS EU	15:10	1,1%	6,8%	43.594

RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:20	1,1%	3,2%	43.146
RTL Kockica	JAN I PIRATI IZ NIGDJEZEMSKE - ANIMIRANA SERIJA	10:36	1,1%	11,0%	43.088
RTL Kockica	MICKEY MOUSE - AMERICKI CRTANI FILM	10:11	1,1%	11,0%	42.697
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:21	1,1%	5,8%	42.540
RTL Kockica	DOKTORICA PLISKO - ANIMIRANA SERIJA	11:01	1,1%	10,5%	42.379
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:27	1,1%	3,1%	42.365
HTV4	BEZ KOMENTARA	13:58	1,1%	6,9%	42.078
RTL Kockica	ZAK STORM - FRANCUSKA ANIMIRANA SERIJA	15:53	1,1%	5,8%	41.716
RTL 2	CSI: MIAMI - AMERICKA KRIMINALISTICKA SERIJA	14:25	1,1%	6,7%	41.403
RTL Kockica	CRTEZ DANA	9:52	1,1%	11,3%	41.394
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:13	1,1%	3,2%	41.067
HTV4	STUDIO 4 - STUDIO	14:38	1,0%	6,7%	40.627
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	16:13	1,0%	5,2%	40.583
Doma TV	LUDI ZA AUTIMA - REALITY SERIJA	19:14	1,0%	2,9%	40.156
HTV4	VRIJEME DANAS RH	13:56	1,0%	6,5%	39.647
RTL 2	VECERA ZA 5 - LIFESTYLE EMISIJA	10:28	1,0%	10,1%	39.454
Doma TV	LUDI ZA AUTIMA - REALITY SERIJA	18:55	1,0%	3,2%	38.801
HTV4	BEZ KOMENTARA	13:53	1,0%	6,4%	38.625
HTV2	OPROSTAJNO PISMO - AMERICKA DRAMA	23:45	1,0%	8,9%	38.346
RTL Kockica	MIRACULOUS: PUSTOLOVINE BUBAMARE I CRNOG MACKA - ANIMI. SERIJA	15:29	1,0%	5,8%	38.215
HTV4	EUROGRADANI	14:49	1,0%	6,1%	38.010
RTL 2	MODERNA OBITELJ - AMERICKA HUMORISTICNA SERIJA	23:54	1,0%	7,2%	37.954
RTL Kockica	SUPER WINGS - ANIMIRANA SERIJA	9:38	1,0%	10,5%	37.626
RTL Kockica	MALI IZVIDACI - ZABAVNO EDUKATIVNA EMISIJA	9:59	1,0%	10,1%	37.529

Table S3: Daily statistics for all programmes on Croatian television on 03 Oct 2018 that were viewed by at least 1% of total population.

Channel	Description	Start time	% total population	% active viewers	Number of viewers
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	20:21	17,0%	40,0%	669.318
NovaTV	DNEVNIK NOVA TV	19:15	15,7%	41,1%	617.025
NovaTV	FARMA - DNEVNA EMISIJA	21:25	12,1%	29,7%	476.048
NovaTV	NAJAVA DNEVNIK NOVA TV	19:14	8,3%	24,4%	327.423
HTV1	VREMENSKA PROGNOZA HRT1	19:46	8,2%	21,2%	322.689
HTV2	NOGOMET - NAPOLI-LIVERPOOL - 1/2	21:00	8,1%	19,0%	317.534
HTV1	DNEVNIK U 19H	19:00	7,8%	22,2%	306.257
RTL	RTL DANAS (RTL DANAS)	18:30	7,3%	23,3%	287.519
HTV2	NOGOMET - NAPOLI-LIVERPOOL - PRIJENOS	20:55	7,2%	18,2%	284.300
HTV1	VRIJEME DANAS HTV	12:18	7,1%	47,2%	277.209
HTV1	DNEVNIK U PODNE	11:59	7,1%	48,0%	276.745
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	18:24	7,0%	23,1%	275.362
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA U PODNE	12:15	7,0%	47,5%	273.758
HTV2	NOGOMET - NAPOLI-LIVERPOOL - PRIJENOS - 2/2	22:05	7,0%	19,0%	273.571
NovaTV	TRAGOVI - DOKUMENTARNA EMISIJA	22:26	6,9%	22,3%	270.065
NovaTV	VIJESTI NOVA TV	17:00	6,6%	31,1%	258.319
RTL	RTL DIREKT	22:15	6,5%	17,6%	254.959
RTL	RTL DANAS (POTRAGA)	19:22	6,5%	17,9%	253.817
NovaTV	IN MAGAZIN	17:31	6,4%	27,7%	251.232
RTL	ZIVOT NA VAGI - REALITY SHOW	21:06	6,3%	15,1%	248.170
RTL	RTL DANAS	18:30	6,3%	18,5%	247.861
HTV1	SAT PRIJE DNEVNIKA U 19H	18:59	6,1%	19,1%	238.839
RTL	RTL DANAS (VRIJEME)	19:33	6,1%	16,3%	238.625
NovaTV	NAJAVA VIJESTI NOVA TV	23:24	6,0%	24,6%	233.707
HTV1	VREMENSKA PROGNOZA HRT1	18:58	5,9%	18,7%	233.282
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA	21:54	5,9%	14,5%	231.960
RTL	NAJAVA RTL DIREKT	22:13	5,8%	14,8%	228.684
HTV1	TEMA DANA - INFORMATIVNA EMISIJA	19:49	5,8%	14,8%	226.919
RTL	RTL DANAS (RTL DANAS)	19:36	5,5%	14,7%	216.377

HTV1	SAT PRIJE DNEVNIKA U PODNE	11:59	5,1%	36,7%	199.867
HTV1	POTJERA - TV KVIZ	18:09	5,1%	18,2%	199.023
RTL	RTL DANAS (RTL DANAS)	19:58	4,8%	12,3%	190.122
NovaTV	VIJESTI NOVA TV	23:25	4,8%	23,2%	187.744
RTL	NAJAVA RTL DANAS	18:28	4,7%	17,2%	185.202
NovaTV	NAJAVA VIJESTI NOVA TV	16:59	4,7%	22,1%	185.170
RTL	RTL VIJESTI	16:30	4,7%	24,0%	184.495
RTL	RTL DANAS (SPORT)	19:44	4,2%	10,7%	163.947
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	16:53	3,9%	18,7%	152.899
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	20:04	3,9%	9,2%	151.585
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA I SAZECI	23:01	3,8%	16,0%	149.563
HTV1	SPONE LJUBAVI - BRAZILSKA TELENOVELA	12:27	3,7%	24,1%	146.604
HTV1	DOBRO JUTRO HRVATSKA	6:55	3,7%	42,4%	145.605
RTL	ZIVOT NA VAGI - REALITY SHOW	16:59	3,6%	16,2%	141.854
RTL	ZIVOT NA VAGI - REALITY SHOW	22:56	3,6%	12,5%	140.577
HTV1	HRVATSKA LUTRIJA - IZVLACENJE BROJEVA LOTA	20:00	3,5%	8,9%	137.983
RTL	NAJAVA RTL VIJESTI	16:28	3,5%	18,3%	137.475
HTV1	DNEVNIK 3	22:51	3,5%	11,8%	136.520
Doma TV	NAVY CIS - AMERICKA KRIMINALISTICKA SERIJA	20:30	3,4%	8,0%	134.273
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA 3	23:06	3,4%	12,6%	133.742
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	11:40	3,3%	27,2%	130.901
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	15:59	3,3%	16,8%	127.465
NovaTV	VIJESTI NOVA TV	14:00	3,2%	18,8%	125.000
RTL	ZIVOT NA VAGI: LATE NIGHT	23:08	3,1%	12,2%	120.155
NovaTV	NAJAVA VIJESTI NOVA TV	13:59	3,1%	17,7%	120.143
HTV1	OTVORENO - POLITICKI TALK SHOW	22:00	3,0%	8,0%	118.814
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA	20:04	3,0%	7,3%	118.520
Doma TV	LUCIFER - AMERICKA KRIMINALISTICKA SERIJA	22:49	3,0%	11,3%	117.583
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	22:03	3,0%	8,0%	117.542
NovaTV	FARMA - DNEVNA EMISIJA	14:51	2,9%	17,3%	115.291
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	14:10	2,9%	17,5%	114.242
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	15:34	2,8%	15,4%	110.723
HTV1	SAT PRIJE DNEVNIKA 3	22:50	2,7%	8,6%	106.599
HTV1	VRIJEME SUTRA HTV	23:14	2,7%	10,4%	104.355

Doma TV	SEAL TEAM - AMERICKA AKCIJSKA SERIJA	21:17	2,7%	6,3%	103.947
HTV2	U OSINJEM GNIJEZDU - KANADSKA DRAMA	13:40	2,5%	15,2%	99.352
NovaTV	KAZNA - TURSKA DRAMSKA SERIJA	9:58	2,5%	22,4%	98.256
HTV1	BONTON	11:35	2,5%	21,5%	96.470
HTV1	JACKIE KENNEDY BORBA ZA LJUDSKA PRAVA - DOKUMENTARNI FILM	20:06	2,4%	5,8%	95.061
HTV1	VIJESTI IZ KULTURE	23:16	2,3%	9,3%	90.602
NovaTV	NAD LIPOM 35	12:51	2,2%	13,6%	86.817
HTV2	REGIONALNI DNEVNIK	16:00	2,2%	11,6%	86.544
RTL	SMRT U RAJU - BRITANSKA KRIMINALISTICKA SERIJA	12:32	2,2%	13,8%	85.383
HTV1	EKO ZONA - EMISIJA O EKOLOGIJI	11:07	2,1%	20,0%	82.245
NovaTV	LJUBAV U CETRDESETOJ - AMERICKA ROMANTICNA KOMEDIJA	23:51	2,0%	18,9%	79.376
Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	19:39	2,0%	5,0%	78.636
HTV1	VETERINAR ENGEL - NJEMACKA SERIJA	10:21	2,0%	17,7%	77.874
HTV2	ZEMLJE-LJUDI-PUSTOLOVINE - DOKUMENTARNA SERIJA	15:12	2,0%	11,5%	77.584
RTL	SHOPPING KRALJICA - LIFESTYLE EMISIJA	13:39	1,9%	11,6%	76.251
RTL Kockica	A JE TO - ANIMIRANI FILM	19:46	1,9%	5,0%	75.647
HTV1	VIJESTI U 5	16:59	1,9%	8,9%	74.180
HTV1	HRVATSKA LUTRIJA - REZULTAT IZVLACENJA LOTA	21:00	1,9%	4,3%	73.579
RTL Kockica	A JE TO - ANIMIRANI FILM	19:37	1,9%	4,9%	72.8x3
HTV2	SEOSKA GOZBA - GASTRO PUTOPISNA DOKUMENTARNA SERIJA	17:33	1,8%	8,0%	71.869
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:03	1,8%	4,2%	71.382
HTV2	ODMORI SE, ZASLUZIO SI - HRVATSKA HUMORISTICNA SERIJA	18:21	1,8%	6,3%	71.076
RTL	HORVATOVI - HRVATSKA OBITELJSKA DRAMSKA SERIJA	14:38	1,8%	10,9%	70.774
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	13:01	1,7%	10,6%	66.715
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:32	1,7%	4,0%	65.911
RTL 2	KRV NIJE VODA - HRVATSKA DOKUMENTARNA DRAMA	11:56	1,7%	11,2%	65.343
RTL 2	SUDNICA - SHOW	10:58	1,7%	14,8%	65.097
Doma TV	TESKI ZLOCINI - AMERICKA KRIMINALISTICKA SERIJA	23:35	1,6%	10,8%	64.526
HTV1	DR. OZ - TALK SHOW	13:17	1,6%	10,0%	64.371
HTV1	POLA URE KULTURE - KULTURNO OBRAZOVNA EMISIJA	21:25	1,6%	3,9%	64.153
RTL 2	MONK - AMERICKA KRIMINALISTICKA SERIJA	20:38	1,6%	3,8%	64.103

HTV2	NAGOVOR - BRITANSKO AMERICKA ROMANTICNA DRAMA	23:48	1,6%	14,1%	62.636
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	12:39	1,6%	10,2%	62.009
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	15:09	1,6%	9,1%	61.992
NovaTV	IN MAGAZIN	11:59	1,5%	10,2%	60.223
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:57	1,5%	3,8%	60.084
HTV1	VRIJEME SUTRA HTV	17:14	1,5%	7,2%	59.690
HTV3	NASE MALO MISTO - DRAMSKA SERIJA	20:05	1,5%	3,6%	59.236
RTL Kockica	DOKTORICA PLISKO - ANIMIRANA SERIJA	17:41	1,5%	6,8%	59.205
HTV1	HAK: PROMET INFO	17:16	1,5%	7,0%	58.095
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	16:42	1,5%	7,4%	57.873
RTL Kockica	MALI IZVIDACI - ZABAVNO EDUKATIVNA EMISIJA	16:36	1,5%	7,4%	57.680
RTL 2	ZATOCENI U INOZEMSTVU - DOKUMENTARNA EMISIJA	16:03	1,5%	7,5%	57.507
RTL 2	DR. HOUSE - AMERICKA DRAMSKA SERIJA	18:55	1,5%	4,2%	57.207
RTL Kockica	KUNG FU PANDA - AMERICKA ANIMIRANA SERIJA	16:11	1,4%	7,5%	55.831
HTV1	DOBAR DAN, HRVATSKA	15:00	1,4%	8,4%	55.557
RTL Kockica	MICKEY MOUSE - AMERICKI CRTANI FILM	16:51	1,4%	6,7%	55.324
RTL Kockica	JAN I PIRATI IZ NIGDJEZEMSKE - ANIMIRANA SERIJA	17:15	1,4%	6,7%	55.183
RTL 2	ZASTITA GRANICA: KANADA - DOKUMENTARNA SERIJA	18:34	1,4%	4,7%	54.269
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	6:33	1,4%	29,4%	54.032
HTV1	FRANKIE DRAKE ISTRAZUJE - KANADSKA KRIMINALISTICKA SERIJA	15:53	1,4%	7,3%	53.904
HTV1	KOD NAS DOMA - MOZAICNA EMISIJA	17:20	1,4%	6,2%	52.878
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:24	1,3%	6,3%	51.794
HTV2	ZAVOLITE SVOJ VRT UZ ALANA TICHMARSHA - DOKUMENTARNA SERIJA	12:52	1,3%	8,3%	51.787
RTL	BLUE BLOODS - AMERICKA KRIMINALISTICKA SERIJA	11:36	1,3%	9,5%	51.686
RTL Kockica	A JE TO - ANIMIRANI FILM	19:28	1,3%	3,5%	51.057
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:04	1,3%	6,1%	50.574
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	19:52	1,3%	3,2%	50.505
HTV1	POTROSACKI KOD - INFORMATIVNA EMISIJA	14:01	1,3%	7,6%	50.241
HTV2	CAROBNI BOTNICKI ZALJEV - DOKUMENTARNA SERIJA	16:44	1,3%	6,0%	49.523
RTL Kockica	MALI ZNANSTVENICI - ZABAVNO EDUKATIVNA EMISIJA	13:43	1,2%	7,3%	48.735

RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:36	1,2%	3,8%	48.428
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:17	1,2%	3,2%	47.903
Doma TV	LUDI ZA AUTIMA - REALITY SERIJA	19:17	1,2%	3,3%	47.399
HTV4	STUDIO 4 - STUDIO	14:11	1,2%	7,1%	47.374
HTV1	BROOKLYN 99 - AMERICKA HUMORISTICNA SERIJA	23:27	1,2%	6,0%	47.074
RTL Kockica	ZAK STORM - FRANCUSKA ANIMIRANA SERIJA	15:48	1,2%	6,5%	46.968
RTL Kockica	JAN I PIRATI IZ NIGDJEZEMSKE - ANIMIRANA SERIJA	10:24	1,2%	10,5%	46.873
HTV4	BEZ KOMENTARA	14:57	1,2%	7,3%	46.518
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:38	1,2%	5,4%	46.187
HTV4	VRIJEME DANAS RH	14:10	1,2%	6,9%	45.971
RTL Kockica	CRTEZ DANA	9:41	1,2%	11,6%	45.721
RTL	BLUE BLOODS - AMERICKA KRIMINALISTICKA SERIJA	10:41	1,2%	10,7%	45.546
HTV2	TRAGOVIMA ISTRAZIVACICE - DOKUMENTARNA SERIJA	13:16	1,2%	7,2%	45.087
HTV4	BEZ KOMENTARA	14:52	1,2%	7,1%	45.027
HTV4	STUDIO 4 - STUDIO	13:31	1,1%	6,8%	44.507
RTL 2	VECERA ZA 5 - LIFESTYLE EMISIJA	10:28	1,1%	9,9%	44.247
RTL Kockica	MIRACULOUS: PUSTOLOVINE BUBAMARE I CRNOG MACKA - ANIMI. SERIJA	15:26	1,1%	6,4%	44.040
HTV4	JAVLJANJE: MINISTAR GOSPODARSTVA DARKO HORVAT	14:57	1,1%	6,8%	43.672
RTL Kockica	BEN 10 - AMERICKA ANIMIRANA SERIJA	14:11	1,1%	6,5%	43.366
HTV4	STUDIO 4 - STUDIO	14:38	1,1%	6,6%	42.849
RTL	METRO - AMERICKI AKCIJSKI FILM	23:31	1,1%	9,7%	42.601
RTL Kockica	SOY LUNA - ARGETINSKA SERIJA ZA MLADE	18:06	1,1%	4,0%	42.450
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	13:25	1,1%	6,4%	42.055
RTL Kockica	MALI IZVIDACI - ZABAVNO EDUKATIVNA EMISIJA	9:46	1,1%	10,1%	41.851
RTL Kockica	CAROBNI STAPIC	13:35	1,1%	6,5%	41.653
Doma TV	LUDI ZA AUTIMA - REALITY SERIJA	18:51	1,1%	3,2%	41.328
RTL Kockica	SUPER WINGS - ANIMIRANA SERIJA	9:27	1,0%	11,0%	40.874
HTV4	STUDIO 4 - STUDIO	15:05	1,0%	6,4%	40.732
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:04	1,0%	3,9%	40.183
RTL 2	ZASTITA GRANICA: AUSTRALIJA - DOKUMENTARNA SERIJA	17:57	1,0%	4,1%	40.164
HTV4	VIJESTI HRT4	14:29	1,0%	6,1%	39.655
RTL Kockica	MICKEY MOUSE - AMERICKI CRTANI FILM	9:59	1,0%	9,2%	39.517

RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:20	1,0%	2,8%	39.052
HTV4	BEZ KOMENTARA	14:21	1,0%	6,1%	38.968
RTL 2	CSI: MIAMI - AMERICKA KRIMINALISTICKA SERIJA	14:14	1,0%	5,9%	38.270
Doma TV	NAVY CIS - AMERICKA KRIMINALISTICKA SERIJA	14:46	1,0%	5,9%	38.076
HTV4	VIJESTI IZ SVIJETA	14:23	1,0%	5,9%	37.932
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	17:09	1,0%	4,5%	37.725
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	10:58	1,0%	8,5%	37.694
RTL Kockica	SUPER WINGS - ANIMIRANA SERIJA	9:15	1,0%	10,2%	37.638
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	16:22	1,0%	4,8%	37.602

Table S4: Daily statistics for all programmes on Croatian television on 10 Oct 2018 that were viewed by at least 1% of total population.

Channel	Description	Start time	% total population	% active viewers	Number of viewers
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	21:25	16,6%	41,4%	653.463
NovaTV	DNEVNIK NOVA TV	19:15	16,0%	41,5%	626.836
NovaTV	FARMA - DNEVNA EMISIJA	20:21	14,5%	34,7%	568.138
NovaTV	TRAGOVI - DOKUMENTARNA EMISIJA	22:26	9,0%	30,8%	353.612
NovaTV	NAJAVA DNEVNIK NOVA TV	19:14	8,1%	23,9%	316.758
RTL	RTL DIREKT	22:14	7,8%	21,8%	305.292
HTV1	DNEVNIK U 19H	19:00	7,3%	20,7%	285.060
HTV1	VREMENSKA PROGNOZA HRT1	19:44	7,2%	18,6%	282.314
NovaTV	NAJAVA VIJESTI NOVA TV	23:27	7,1%	31,5%	280.160
RTL	ZIVOT NA VAGI - REALITY SHOW	21:04	7,0%	17,2%	275.240
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	18:24	6,9%	24,0%	272.616
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA U PODNE	12:15	6,8%	43,6%	266.754
HTV1	DNEVNIK U PODNE	11:59	6,7%	44,4%	263.682
RTL	RTL DANAS (RTL DANAS)	18:30	6,6%	21,8%	259.597
RTL	NAJAVA RTL DIREKT	22:14	6,5%	16,7%	255.958
HTV1	VRIJEME DANAS HTV	12:18	6,5%	41,4%	254.101
RTL	RTL DANAS (POTRAGA)	19:22	6,4%	17,6%	250.048
RTL	RTL DANAS (VRIJEME)	19:29	6,2%	16,7%	243.913
NovaTV	VIJESTI NOVA TV	17:00	6,1%	31,8%	239.811
RTL	RTL DANAS	18:29	5,8%	17,4%	229.534
HTV1	SAT PRIJE DNEVNIKA U 19H	18:59	5,6%	18,0%	219.443
HTV1	VREMENSKA PROGNOZA HRT1	18:58	5,5%	17,7%	215.435
NovaTV	IN MAGAZIN	17:32	5,4%	25,4%	209.961
NovaTV	VIJESTI NOVA TV	23:28	5,3%	27,8%	208.573
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	20:01	5,3%	12,8%	207.635
HTV1	TEMA DANA - INFORMATIVNA EMISIJA	19:47	5,2%	13,2%	203.176
NovaTV	NAJAVA VIJESTI NOVA TV	16:59	5,0%	26,7%	196.005
HTV1	SAT PRIJE DNEVNIKA U PODNE	11:59	5,0%	34,8%	194.499
RTL	RTL DANAS (RTL DANAS)	19:33	4,8%	12,9%	189.782

RTL	RTL DANAS (RTL DANAS)	19:54	4,7%	11,8%	182.750
HTV1	POTJERA - TV KVIZ	18:09	4,6%	17,7%	180.943
NovaTV	FARMA - DNEVNA EMISIJA	14:39	4,3%	24,9%	169.963
RTL	RTL DANAS (SPORT)	19:42	4,3%	10,9%	166.979
HTV1	OBITELJ TRUMP: OD IMIGRANTA DO PREDSJEDNIKA - DOKUMENTARNI FILM	20:05	4,1%	9,8%	159.077
NovaTV	VIJESTI NOVA TV	14:00	4,0%	23,5%	156.793
HTV1	SAT PRIJE DNEVNIKA 3	22:53	3,8%	12,9%	147.927
HTV1	HRVATSKA LUTRIJA - IZVLACENJE BROJEVA LOTA	19:58	3,7%	9,4%	147.051
HTV1	DNEVNIK 3	22:54	3,7%	13,3%	146.736
HTV1	HRVATSKA LUTRIJA - REZULTAT IZVLACENJA LOTA	20:54	3,7%	8,9%	145.957
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	15:58	3,7%	19,4%	145.705
RTL	ZIVOT NA VAGI - REALITY SHOW	22:58	3,7%	13,4%	144.353
HTV1	SPONE LJUBAVI - BRAZILSKA TELENOVELA	12:26	3,6%	22,8%	140.704
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	14:17	3,6%	21,5%	139.493
RTL	ZIVOT NA VAGI: LATE NIGHT	23:12	3,5%	14,9%	136.844
HTV1	DOBRO JUTRO HRVATSKA	6:54	3,5%	43,3%	135.973
RTL	NAJAVA RTL DANAS	18:29	3,4%	13,4%	133.940
NovaTV	NAJAVA VIJESTI NOVA TV	13:59	3,3%	19,8%	130.219
HTV1	OTVORENO - POLITICKI TALK SHOW	22:00	3,3%	9,0%	130.003
RTL	RTL VIJESTI	16:29	3,2%	16,7%	124.607
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	20:54	3,1%	7,5%	122.200
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	11:41	3,1%	24,6%	122.145
HTV2	DOBA HEROJA - BRITANSKI AKCIJSKI FILM	21:00	3,1%	7,6%	120.482
Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	20:21	3,0%	7,2%	118.273
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	13:50	3,0%	18,1%	117.645
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	22:48	2,8%	11,1%	111.230
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA 3	23:10	2,8%	10,7%	109.033
RTL	HORVATOVI - HRVATSKA OBITELJSKA DRAMSKA SERIJA	16:55	2,7%	14,3%	105.435
HTV1	VRIJEME SUTRA HTV	23:16	2,7%	10,8%	104.023
RTL	NAJAVA RTL VIJESTI	16:29	2,6%	13,9%	103.250
NovaTV	NIJEDNO DOBRO DJELO - AMERICKI TRILER	23:53	2,6%	24,3%	102.668
HTV2	REGIONALNI DNEVNIK	16:00	2,5%	13,0%	97.466

RTL	ZIVOT NA VAGI - REALITY SHOW	17:02	2,5%	12,1%	96.734
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	21:59	2,5%	6,7%	96.351
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	13:01	2,3%	14,7%	90.817
HTV2	SEOSKA GOZBA - GASTRO PUTOPISNA DOKUMENTARNA SERIJA	17:38	2,3%	10,8%	90.767
HTV1	BONTON	11:33	2,3%	19,9%	90.728
Doma TV	TESKI ZLOCINI - AMERICKA KRIMINALISTICKA SERIJA	23:36	2,3%	15,8%	90.312
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:10	2,3%	5,6%	90.195
Doma TV	SEAL TEAM - AMERICKA AKCIJSKA SERIJA	21:09	2,3%	5,5%	88.345
HTV2	ODMORI SE, ZASLUZIO SI - HRVATSKA HUMORISTICNA SERIJA	18:25	2,2%	7,8%	86.911
HTV1	VIJESTI IZ KULTURE	23:18	2,2%	9,2%	84.812
HTV2	SLATKA ROMANCA - AMERICKA ROMATICNA KOMEDIJA	13:36	2,1%	12,8%	83.807
HTV2	OBITELJSKI ZLOCINI - DOKUMENTARNA SERIJA	20:05	2,1%	5,1%	82.772
NovaTV	KAZNA - TURSKA DRAMSKA SERIJA	9:23	2,1%	23,2%	82.686
RTL 2	MONK - AMERICKA KRIMINALISTICKA SERIJA	20:47	2,1%	5,0%	81.943
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	12:38	2,1%	13,3%	81.655
HTV3	VELO MISTO - DRAMSKA SERIJA	20:05	2,1%	5,0%	81.632
Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	19:30	2,1%	5,3%	81.179
NovaTV	NAD LIPOM 35	12:23	2,1%	13,0%	80.602
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:33	2,0%	4,9%	78.516
HTV1	VIJESTI U 5	16:59	2,0%	10,4%	77.963
HTV1	VETERINAR ENGEL - NJEMACKA SERIJA	10:19	2,0%	19,5%	77.912
RTL Kockica	A JE TO - ANIMIRANI FILM	19:47	2,0%	5,1%	77.529
RTL Kockica	A JE TO - ANIMIRANI FILM	19:40	2,0%	5,1%	77.526
RTL 2	KRV NIJE VODA - HRVATSKA DOKUMENTARNA DRAMA	11:55	2,0%	13,0%	77.152
HTV1	OTKRIVAMO HRVATSKU - DOKUMENTARNA SERIJA	14:28	2,0%	11,5%	76.731
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:58	2,0%	4,9%	76.507
HTV1	VRIJEME SUTRA HTV	17:14	1,9%	9,8%	76.260
HTV2	POVEZANOST DIVLJINOM - DOKUMENTARNA SERIJA	16:44	1,9%	10,0%	75.213
HTV1	POTROSACKI KOD - INFORMATIVNA EMISIJA	14:00	1,9%	11,2%	73.436
RTL	HORVATOVI - HRVATSKA OBITELJSKA DRAMSKA SERIJA	15:40	1,9%	9,8%	72.532
HTV1	POLA URE KULTURE - KULTURNO OBRAZOVNA EMISIJA	21:27	1,8%	4,4%	71.212

HTV1	EKO ZONA - EMISIJA O EKOLOGIJI	11:08	1,8%	16,2%	70.966
HTV1	DR. OZ - TALK SHOW	13:16	1,8%	11,0%	68.931
HTV1	HAK: PROMET INFO	17:15	1,7%	8,7%	67.567
HTV2	ZEMLJE-LJUDI-PUSTOLOVINE - DOKUMENTARNA SERIJA	15:07	1,7%	9,8%	67.229
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	16:40	1,7%	8,6%	64.867
HTV2	ISTINA ILI MIT	13:21	1,7%	10,6%	64.844
NovaTV	IN MAGAZIN	11:30	1,6%	11,6%	62.384
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	10:29	1,6%	14,8%	61.336
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:38	1,6%	5,2%	61.185
RTL Kockica	A JE TO - ANIMIRANI FILM	19:32	1,5%	3,8%	57.100
HTV2	ISTINA ILI MIT	20:50	1,4%	3,4%	56.198
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	19:50	1,4%	3,5%	56.070
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:18	1,4%	4,0%	55.905
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:18	1,4%	3,9%	55.595
HTV1	DOBAR DAN, HRVATSKA	14:59	1,4%	8,1%	55.357
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	16:16	1,4%	7,3%	54.589
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	17:00	1,4%	7,2%	54.319
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	13:26	1,4%	8,3%	53.788
RTL 2	SUDNICA - SHOW	10:55	1,4%	11,9%	53.747
RTL Kockica	KUNG FU PANDA - AMERICKA ANIMIRANA SERIJA	16:14	1,3%	7,0%	52.802
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:25	1,3%	3,7%	52.778
HTV1	BROOKLYN 99 - AMERICKA HUMORISTICNA SERIJA	23:27	1,3%	6,7%	51.064
RTL Kockica	CRTEZ DANA	18:59	1,3%	4,1%	50.708
HTV2	TABU - BRITANSKA DRAMSKA SERIJA	22:34	1,3%	4,6%	50.347
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	14:38	1,3%	7,5%	50.114
RTL Kockica	SOY LUNA - ARGETINSKA SERIJA ZA MLADE	18:13	1,3%	4,8%	49.929
HTV2	ZAVOLITE SVOJ VRT UZ ALANA TICHMARSHA - DOKUMENTARNA SERIJA	12:58	1,3%	8,0%	49.482
Doma TV	DRAGULJI NA KOTACIMA - AMERICKA REALITY SERIJA	19:06	1,2%	3,6%	48.577
RTL Kockica	NASA MALA KLINIKA - HRVATSKA HUMORISTICNA SERIJA	19:55	1,2%	3,0%	48.575
RTL	SHOPPING KRALJICA - LIFESTYLE EMISIJA	13:38	1,2%	7,5%	48.483
HTV1	KOD NAS DOMA - MOZAICNA EMISIJA	17:20	1,2%	6,2%	48.086

Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	0:29	1,2%	12,4%	47.712
RTL	SMRT U RAJU - BRITANSKA KRIMINALISTICKA SERIJA	12:31	1,2%	7,7%	47.697
RTL Kockica	BAKA PRICA NAJLJEPSE PRICE	19:05	1,2%	3,7%	47.551
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	6:35	1,2%	27,4%	47.527
HTV1	FRANKIE DRAKE ISTRAZUJE - KANADSKA KRIMINALISTICKA SERIJA	15:52	1,2%	6,4%	47.368
NovaTV	CUVARI ZAKONA - AMERICKI AKCIJSKI FILM	2:00	1,2%	22,5%	47.156
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:09	1,2%	5,0%	47.036
RTL 2	CSI: MIAMI - AMERICKA KRIMINALISTICKA SERIJA	14:13	1,2%	7,1%	46.975
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:38	1,2%	6,0%	46.750
RTL Kockica	MALI IZVIDACI - ZABAVNO EDUKATIVNA EMISIJA	16:39	1,2%	6,2%	46.602
RTL 2	DR. HOUSE - AMERICKA DRAMSKA SERIJA	18:54	1,2%	3,4%	46.545
RTL Kockica	MIRACULOUS: PUSTOLOVINE BUBAMARE I CRNOG MACKA - ANIMI. SERIJA	15:29	1,2%	6,6%	46.392
RTL Kockica	MR. BEAN - HUMORISTICNA SERIJA	20:56	1,2%	2,8%	46.169
HTV4	ZASJEDANJE HRVATSKOG SABORA - PRIJENOS	11:55	1,1%	7,1%	44.929
HTV3	MIRIS BARUTA - AMERICKA SERIJA	13:30	1,1%	6,8%	44.101
RTL Kockica	MUCKE - BRITANSKA HUMORISTICNA SERIJA	22:15	1,1%	3,1%	42.854
RTL Kockica	A JE TO - ANIMIRANI FILM	12:35	1,1%	7,0%	42.814
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:11	1,1%	3,2%	42.784
RTL Kockica	DOKTORICA PLISKO - ANIMIRANA SERIJA	17:46	1,1%	5,1%	41.818
RTL	BLUE BLOODS - AMERICKA KRIMINALISTICKA SERIJA	10:41	1,1%	9,7%	41.333
RTL Kockica	CAROBNI STAPIC	13:39	1,1%	6,6%	41.315
RTL Kockica	MUCKE: ROMANSA U PECKHAMU - BRITANSKA SERIJA	21:27	1,1%	2,6%	41.277
HTV3	RAZGLEDNICE S BORNEA - PUTOPISNA EMISIJA	19:28	1,1%	2,7%	41.123
RTL Kockica	A JE TO - ANIMIRANI FILM	12:20	1,0%	6,8%	40.697
RTL Kockica	A JE TO - ANIMIRANI FILM	12:27	1,0%	6,7%	40.680
NovaTV	CUVARI ZAKONA - AMERICKI AKCIJSKI FILM	1:33	1,0%	16,0%	40.010
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	23:29	1,0%	5,9%	39.831
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	15:09	1,0%	5,5%	38.396
HTV1	BONTON	16:35	1,0%	5,1%	37.840
RTL	RUZNE RIJECI - AMERICKA KOMEDIJA	23:33	1,0%	7,8%	37.424
HTV4	STUDIO 4 - STUDIO	10:41	1,0%	8,6%	37.327

RTL Kockica	MALI ZNANSTVENICI - ZABAVNO EDUKATIVNA EMISIJA	13:48	1,0%	5,7%	37.286
HTV3	VELO MISTO - DRAMSKA SERIJA	15:16	1,0%	5,1%	37.145

Table S5: Daily statistics for all programmes on Croatian television on 17 Oct 2018 that were viewed by at least 1% of total population.

Channel	Description	Start time	% total population	% active viewers	Number of viewers
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	21:30	15,8%	38,8%	619.026
NovaTV	DNEVNIK NOVA TV	19:15	13,7%	36,3%	537.454
NovaTV	FARMA - DNEVNA EMISIJA	20:13	13,6%	32,0%	534.933
NovaTV	TRAGOVI - DOKUMENTARNA EMISIJA	22:31	8,2%	29,4%	321.104
HTV1	VREMENSKA PROGNOZA HRT1	19:45	8,1%	21,4%	319.599
RTL	RTL DANAS (POTRAGA)	19:22	8,0%	22,6%	314.453
RTL	RTL DANAS (RTL DANAS)	18:30	7,9%	24,6%	309.305
RTL	RTL DIREKT	22:14	7,7%	20,8%	301.376
NovaTV	NAJAVA DNEVNIK NOVA TV	19:14	7,7%	22,5%	300.828
HTV1	DNEVNIK U 19H	19:00	7,5%	21,5%	293.287
RTL	RTL DANAS (VRIJEME)	19:34	7,4%	20,5%	289.426
RTL	RTL DANAS	18:30	7,2%	20,9%	282.014
HTV1	DNEVNIK U PODNE	12:00	7,2%	46,9%	281.892
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA U PODNE	12:15	7,2%	47,0%	281.553
NovaTV	RAT RUZA - TURSKA DRAMSKA SERIJA	18:23	7,1%	23,0%	279.035
HTV1	VRIJEME DANAS HTV	12:18	7,0%	45,3%	273.208
HTV1	TEMA DANA - INFORMATIVNA EMISIJA	19:48	6,6%	16,8%	257.876
NovaTV	VIJESTI NOVA TV	17:00	6,5%	31,6%	254.556
NovaTV	NAJAVA VIJESTI NOVA TV	23:29	6,4%	30,6%	251.639
RTL	RTL DANAS (RTL DANAS)	19:37	6,2%	17,3%	245.181
NovaTV	IN MAGAZIN	17:32	6,2%	27,1%	244.167
RTL	ZIVOT NA VAGI - REALITY SHOW	21:04	6,2%	14,7%	241.960
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	20:02	6,2%	14,6%	241.534
RTL	RTL DANAS (RTL DANAS)	19:57	5,8%	14,5%	229.166
NovaTV	NAJAVA VIJESTI NOVA TV	16:59	5,8%	28,4%	226.640
RTL	NAJAVA RTL DIREKT	22:14	5,6%	14,0%	219.473
RTL	RTL DANAS (SPORT)	19:47	5,5%	14,2%	216.683
HTV1	SAT PRIJE DNEVNIKA U 19H	18:59	5,4%	16,8%	212.206
HTV1	VREMENSKA PROGNOZA HRT1	18:58	5,4%	16,7%	210.676

HTV1	SAT PRIJE DNEVNIKA U PODNE	11:59	5,2%	36,6%	205.274
HTV1	POTJERA - TV KVIZ	18:10	5,2%	18,1%	204.278
RTL	NAJAVA RTL DANAS	18:29	5,0%	17,4%	197.488
NovaTV	VIJESTI NOVA TV	23:30	4,8%	26,4%	189.496
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	15:59	4,3%	21,9%	169.064
HTV1	HRVATSKA LUTRIJA - IZVLACENJE BROJEVA LOTA	20:01	4,3%	10,6%	167.446
RTL	ZIVOT NA VAGI - REALITY SHOW	22:56	4,1%	15,2%	162.367
HTV2	UTJEHA - AMERICKI TRILER	21:00	3,9%	9,6%	154.594
HTV1	IMPERIJ - BRAZILSKA TELENOVELA	12:28	3,9%	26,0%	152.731
NovaTV	FARMA - DNEVNA EMISIJA	14:46	3,5%	20,0%	135.943
HTV1	DOBRO JUTRO HRVATSKA	6:54	3,4%	40,0%	133.556
Doma TV	MENTALIST - AMERICKA KRIMINALISTICKO DRAMSKA SERIJA	20:10	3,3%	7,8%	129.589
NovaTV	VIJESTI NOVA TV	14:00	3,3%	20,5%	127.557
HTV3	VELO MISTO - DRAMSKA SERIJA	20:05	3,2%	7,6%	126.915
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	13:51	3,0%	19,1%	118.370
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	14:18	3,0%	18,7%	118.337
NovaTV	NAJAVA VIJESTI NOVA TV	13:59	3,0%	19,6%	116.827
RTL	RTL VIJESTI	16:29	3,0%	15,1%	116.378
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	22:42	3,0%	11,6%	116.117
RTL	ZIVOT NA VAGI: LATE NIGHT	23:03	2,9%	12,2%	115.597
HTV1	OTVORENO - POLITICKI TALK SHOW	21:59	2,9%	7,7%	114.742
NovaTV	KAZNA - TURSKA DRAMSKA SERIJA	9:47	2,9%	26,8%	113.539
RTL	ZIVOT NA VAGI - REALITY SHOW	17:01	2,7%	12,4%	107.225
Doma TV	SEAL TEAM - AMERICKA AKCIJSKA SERIJA	21:02	2,6%	6,2%	103.664
HTV1	SAT PRIJE DNEVNIKA 3	22:53	2,6%	9,1%	103.535
HTV2	PAKLENA MEDICINSKA SESTRA - AMERICKI TRILER	13:36	2,6%	16,4%	102.405
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	11:42	2,6%	20,7%	101.906
HTV2	REGIONALNI DNEVNIK	16:00	2,6%	13,3%	101.567
RTL	NAJAVA RTL VIJESTI	16:29	2,6%	13,1%	100.234
HTV1	DNEVNIK 3	22:53	2,5%	9,4%	99.768
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	21:53	2,5%	6,5%	97.647
HTV1	ZLATNA IGLA - EMISIJA POD POKROVITELJSTVOM	20:06	2,5%	5,8%	96.740
HTV2	OBITELJSKI ZLOCINI - DOKUMENTARNA SERIJA	20:05	2,5%	5,9%	96.443
HTV2	ISTINA ILI MIT	20:49	2,5%	5,7%	96.350

RTL	SHOPPING KRALJICA - LIFESTYLE EMISIJA	16:56	2,4%	11,7%	92.656
HTV1	VETERINAR ENGEL - NJEMACKA SERIJA	10:20	2,3%	19,7%	88.277
NovaTV	NAD LIPOM 35	12:41	2,2%	14,7%	87.553
RTL	PREVODITELJICA - BRITANSKO AMERICKI TRILER	23:26	2,2%	18,9%	84.575
HTV2	ODMORI SE, ZASLUZIO SI - HRVATSKA HUMORISTICNA SERIJA	17:42	2,1%	9,2%	82.194
Doma TV	TESKI ZLOCINI - AMERICKA KRIMINALISTICKA SERIJA	23:36	2,1%	14,3%	81.895
HTV2	DIVLJI KARPATI - DOKUMENTARNA SERIJA	16:45	2,1%	10,0%	80.461
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	22:03	2,1%	5,1%	80.385
HTV1	EKO ZONA - EMISIJA O EKOLOGIJI	11:09	2,0%	17,2%	79.954
Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	19:19	2,0%	5,4%	79.885
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA 3	23:09	2,0%	8,0%	78.747
HTV2	SEOSKA GOZBA - GASTRO PUTOPISNA DOKUMENTARNA SERIJA	18:17	2,0%	6,7%	77.981
HTV1	BONTON	11:36	2,0%	16,1%	76.616
HTV1	HRVATSKA LUTRIJA - REZULTAT IZVLACENJA LOTA	21:06	1,9%	4,5%	75.801
HTV1	VIJESTI U 5	16:59	1,9%	9,4%	75.502
HTV1	VRIJEME SUTRA HTV	17:14	1,9%	9,1%	73.705
RTL	HORVATOVI - HRVATSKA OBITELJSKA DRAMSKA SERIJA	14:42	1,9%	11,2%	73.704
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:21	1,9%	5,1%	73.070
HTV1	KOD NAS DOMA - MOZAICNA EMISIJA	17:20	1,9%	8,6%	72.645
HTV1	VRIJEME SUTRA HTV	23:13	1,9%	7,7%	72.550
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	13:02	1,8%	11,9%	70.158
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:36	1,8%	4,2%	68.946
HTV1	HAK: PROMET INFO	17:15	1,8%	8,6%	68.908
HTV1	DR. OZ - TALK SHOW	13:19	1,7%	11,1%	67.466
RTL 2	MONK - AMERICKA KRIMINALISTICKA SERIJA	20:41	1,7%	4,0%	67.194
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	19:51	1,7%	4,1%	66.511
HTV2	ISTINA ILI MIT	13:28	1,7%	10,9%	66.044
NovaTV	RAT RUZA - TURSKA DRAMSKA SERIJA	10:52	1,7%	14,1%	65.683
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:40	1,7%	5,8%	65.237
RTL Kockica	ZAK STORM - FRANCUSKA ANIMIRANA SERIJA	15:50	1,7%	8,6%	64.708
RTL	SHOPPING KRALJICA - LIFESTYLE EMISIJA	15:39	1,6%	8,6%	64.180

RTL Kockica	MIRACULOUS: PUSTOLOVINE BUBAMARE I CRNOG MACKA - ANIMI. SERIJA	15:25	1,6%	9,0%	63.083
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	16:47	1,6%	7,8%	62.668
RTL 2	KRV NIJE VODA - HRVATSKA DOKUMENTARNA DRAMA	11:57	1,6%	10,6%	62.375
HTV1	POTROSACKI KOD - INFORMATIVNA EMISIJA	14:03	1,6%	9,8%	61.046
Doma TV	MENTALIST - AMERICKA KRIMINALISTICKO DRAMSKA SERIJA	15:59	1,6%	7,9%	60.807
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	12:40	1,6%	10,3%	60.785
RTL 2	SUDNICA - SHOW	10:56	1,5%	12,6%	59.636
NovaTV	IN MAGAZIN	11:50	1,5%	10,2%	59.213
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	15:10	1,5%	8,4%	58.848
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	13:41	1,5%	9,4%	58.797
HTV1	VIJESTI IZ KULTURE	23:15	1,5%	6,5%	58.720
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	16:41	1,4%	7,2%	56.037
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	6:34	1,4%	34,1%	54.464
HTV2	MOST - SVEDSKO DANSKA KRIMINALISTICKA SERIJA	22:41	1,4%	5,5%	54.448
Doma TV	DRAGULJI NA KOTACIMA - AMERICKA REALITY SERIJA	18:56	1,4%	4,1%	54.168
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	15:07	1,3%	7,5%	52.246
Doma TV	LUDI ZA AUTIMA - REALITY SERIJA	18:29	1,3%	4,3%	51.342
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:39	1,3%	6,0%	50.927
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:17	1,3%	3,0%	50.295
HTV1	POLA URE KULTURE - KULTURNO OBRAZOVNA EMISIJA	21:27	1,3%	3,0%	49.817
NovaTV	NA TAJNOM ZADATKU - AMERICKA AKCIJSKA KOMEDIJA	23:56	1,3%	12,5%	49.631
HTV4	VIJESTI IZ SVIJETA	13:24	1,3%	8,3%	49.215
RTL	SMRT U RAJU - BRITANSKA KRIMINALISTICKA SERIJA	12:35	1,3%	8,3%	49.102
RTL Kockica	SLUGTTERA - KANADSKA ANIMIRANA SERIJA	15:02	1,2%	7,5%	48.562
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:08	1,2%	2,9%	48.264
HTV4	BEZ KOMENTARA	13:28	1,2%	8,0%	48.143
HTV1	POGLED PREKO GRANICE - HRVATI U BIH	14:30	1,2%	7,5%	48.086
RTL 2	DR. HOUSE - AMERICKA DRAMSKA SERIJA	18:55	1,2%	3,6%	47.845
RTL 2	CSI: MIAMI - AMERICKA KRIMINALISTICKA SERIJA	14:12	1,2%	7,5%	47.632
RTL Kockica	KUNG FU PANDA - AMERICKA ANIMIRANA SERIJA	16:14	1,2%	6,1%	46.973

RTL Kockica	IDEMO U ZOO - ZABAVNO EDUKATIVNA EMISIJA	14:57	1,2%	7,3%	46.573
HTV2	KRISKE SIRA - DOKUMENTARNA SERIJA	13:01	1,2%	7,9%	46.244
HTV2	METROPOLIS - DOKUMENTARNA SERIJA	15:09	1,2%	6,5%	45.024
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	0:29	1,1%	11,7%	44.767
RTL 2	ZASTITA GRANICA: AUSTRALIJA - DOKUMENTARNA SERIJA	17:58	1,1%	4,5%	44.060
RTL 2	VECERA ZA 5 - LIFESTYLE EMISIJA	10:28	1,1%	9,7%	43.666
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	14:19	1,1%	6,8%	43.345
HTV1	VELECASNI BROWN - BRITANSKA SERIJA	15:55	1,1%	5,7%	43.329
HTV2	CHARLEY VARRICK - AMERICKI KRIMINALISTICKI FILM	23:43	1,1%	9,7%	43.223
Doma TV	U DIVLJINI SA BEAROM GRYLLSOM - REALITY SERIJA	17:38	1,1%	4,6%	42.493
NovaTV	ZACIN LJUBAVI - TURSKA DRAMSKA SERIJA	8:25	1,1%	11,9%	41.836
HTV4	VIJESTI HRT4	15:26	1,1%	6,1%	41.573
HTV1	DOBAR DAN, HRVATSKA	14:59	1,0%	6,0%	40.899
HTV1	BROOKLYN 99 - AMERICKA HUMORISTICNA SERIJA	23:25	1,0%	5,4%	40.644
RTL Kockica	CRTEZ DANA	9:31	1,0%	11,1%	40.484
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	13:26	1,0%	6,6%	40.338
HTV4	SJEDNICA VLADE RH - PRIJENOS	12:23	1,0%	6,7%	39.610
RTL Kockica	LUNA PETUNIA - AMERICKA ANIMIRANA SERIJA	14:44	1,0%	6,1%	39.449
RTL Kockica	A JE TO - ANIMIRANI FILM	19:31	1,0%	2,7%	39.298
HTV4	BEZ KOMENTARA	15:32	1,0%	5,6%	38.836
RTL Kockica	DOKTORICA PLISKO - ANIMIRANA SERIJA	17:44	1,0%	4,4%	38.835
RTL Kockica	MICKEY MOUSE - AMERICKI CRTANI FILM	16:53	1,0%	4,8%	38.477
RTL Kockica	SUPER WINGS - ANIMIRANA SERIJA	9:16	1,0%	10,6%	38.277
RTL 2	MODERNA OBITELJ - AMERICKA HUMORISTICNA SERIJA	23:13	1,0%	4,4%	38.187
HTV4	BEZ KOMENTARA	13:29	1,0%	6,2%	37.575
RTL Kockica	MALI IZVIDACI - ZABAVNO EDUKATIVNA EMISIJA	9:37	1,0%	9,9%	37.553
HTV4	BEZ KOMENTARA	15:34	1,0%	5,3%	37.277

Table S6: Daily statistics for all programmes on Croatian television on 24 Oct 2018 that were viewed by at least 1% of total population.

Channel	Description	Start time	% total population	% active viewers	Number of viewers
NovaTV	DNEVNIK NOVA TV	19:15	15,4%	38,1%	603.240
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	21:32	15,1%	35,1%	594.681
NovaTV	FARMA - DNEVNA EMISIJA	20:20	13,6%	30,7%	535.368
HTV2	NOGOMET - BARCELONA-INTER - PRIJENOS - 1/2	21:01	9,9%	22,0%	390.132
NovaTV	VIJESTI NOVA TV	17:00	8,8%	35,0%	347.358
NovaTV	IN MAGAZIN	17:31	8,8%	30,2%	344.614
RTL	RTL DANAS (RTL DANAS)	18:30	8,5%	23,9%	333.654
NovaTV	NAJAVA DNEVNIK NOVA TV	19:14	8,5%	22,8%	332.362
HTV1	VREMENSKA PROGNOZA HRT1	19:47	8,4%	20,9%	331.342
HTV1	DNEVNIK U 19H	18:59	8,4%	22,0%	328.819
HTV2	NOGOMET - BARCELONA-INTER - PRIJENOS	20:56	8,4%	19,8%	327.819
HTV1	DNEVNIK U PODNE	12:00	8,3%	52,0%	325.509
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA U PODNE	12:16	8,2%	49,5%	322.812
HTV1	VRIJEME DANAS HTV	12:19	8,2%	49,3%	320.136
NovaTV	NE DIRAJ MI MAMU - HUMORISTICNA SERIJA	22:28	8,1%	25,6%	317.010
HTV2	NOGOMET - BARCELONA-INTER - PRIJENOS - 2/2	22:04	8,0%	20,5%	313.569
NovaTV	NAJAVA VIJESTI NOVA TV	16:59	7,9%	32,5%	309.831
RTL	RTL DANAS	18:30	7,5%	20,0%	293.669
NovaTV	RAT RUZA - TURSKA DRAMSKA SERIJA	18:23	7,4%	21,2%	290.863
RTL	RTL DANAS (POTRAGA)	19:20	7,4%	19,1%	290.434
RTL	RTL DANAS (VRIJEME)	19:32	7,3%	18,6%	286.321
RTL	RTL DANAS (RTL DANAS)	19:35	7,2%	18,2%	281.555
RTL	ZIVOT NA VAGI - REALITY SHOW	21:05	6,5%	14,7%	256.728
HTV1	SAT PRIJE DNEVNIKA U 19H	18:59	6,4%	18,1%	251.271
HTV1	POTJERA - TV KVIZ	18:09	6,4%	19,1%	250.244
HTV1	TEMA DANA - INFORMATIVNA EMISIJA	19:50	6,3%	15,5%	248.096
RTL	NAJAVA RTL DANAS	18:29	6,3%	18,8%	247.594
HTV1	VREMENSKA PROGNOZA HRT1	18:58	6,2%	17,6%	244.421
HTV1	SAT PRIJE DNEVNIKA U PODNE	11:59	6,1%	41,0%	240.915

RTL	RTL DIREKT	22:15	5,9%	15,4%	231.497
RTL	RTL DANAS (SPORT)	19:45	5,6%	13,9%	220.368
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	20:01	5,5%	12,8%	217.288
RTL	NAJAVA RTL DIREKT	22:14	5,5%	13,1%	214.945
RTL	RTL DANAS (RTL DANAS)	19:57	5,2%	12,7%	204.694
NovaTV	NA GRANICI - HRVATSKA DRAMSKA SERIJA	15:59	5,0%	23,4%	197.343
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA	21:53	4,9%	11,3%	192.959
NovaTV	NAJAVA VIJESTI NOVA TV	23:20	4,8%	20,4%	188.088
NovaTV	VIJESTI NOVA TV	23:20	4,6%	21,7%	181.364
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA I SAZECI	22:59	4,4%	18,6%	173.557
HTV1	HRVATSKA LUTRIJA - IZVLACENJE BROJEVA LOTA	20:00	4,1%	9,9%	161.554
NovaTV	VIJESTI NOVA TV	14:00	4,1%	24,5%	161.443
HTV1	DOBRO JUTRO HRVATSKA	6:54	4,0%	43,8%	155.232
RTL	RTL VIJESTI	16:30	3,8%	17,2%	148.243
HTV2	ODMORI SE, ZASLUZIO SI - HRVATSKA HUMORISTICNA SERIJA	17:35	3,8%	13,2%	148.008
RTL	ZIVOT NA VAGI - REALITY SHOW	22:58	3,6%	13,4%	141.241
NovaTV	NAJAVA VIJESTI NOVA TV	13:59	3,6%	22,1%	140.509
HTV2	NOGOMETNA LIGA PRVAKA - EMISIJA	20:04	3,6%	8,2%	139.647
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	11:43	3,6%	26,9%	139.267
HTV1	IMPERIJ - BRAZILSKA TELENOVELA	12:29	3,5%	22,6%	138.050
Doma TV	MENTALIST - AMERICKA KRIMINALISTICKO DRAMSKA SERIJA	21:00	3,5%	7,8%	137.305
NovaTV	FARMA - DNEVNA EMISIJA	14:52	3,5%	18,4%	136.389
Doma TV	MENTALIST - AMERICKA KRIMINALISTICKO DRAMSKA SERIJA	20:09	3,5%	8,0%	136.286
HTV1	SMRTONOSNI LAZNI LIJEKOVI - DOKUMENTARNI FILM	20:05	3,4%	7,8%	133.478
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	21:53	3,4%	8,4%	133.010
NovaTV	ZAUVIJEK SUSJEDI - HRVATSKA HUMORISTICNA SERIJA	14:11	3,3%	18,5%	129.093
HTV2	REGIONALNI DNEVNIK	16:00	3,2%	15,4%	125.554
HTV1	DNEVNIK 3	22:51	3,1%	10,7%	122.607
RTL	ZIVOT NA VAGI - REALITY SHOW	16:58	3,1%	11,2%	121.021
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	22:45	3,0%	11,3%	119.441
HTV1	HRVATSKA LUTRIJA - REZULTAT IZVLACENJA LOTA	20:58	3,0%	6,8%	118.555
HTV2	SEOSKA GOZBA - GASTRO PUTOPISNA DOKUMENTARNA SERIJA	18:16	2,9%	8,5%	114.086
HTV2	PLANET ZEMLJA - DOKUMENTARNA SERIJA	16:43	2,9%	11,7%	113.686
HTV1	VETERINAR ENGEL - NJEMACKA SERIJA	10:20	2,9%	24,3%	113.564

HTV1	VIJESTI U 5	16:59	2,8%	11,5%	110.942
NovaTV	NAD LIPOM 35	12:42	2,7%	17,2%	106.038
HTV1	BONTON	11:36	2,7%	22,1%	105.802
RTL	NAJAVA RTL VIJESTI	16:29	2,7%	12,6%	105.329
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	20:59	2,7%	6,0%	104.604
NovaTV	KAZNA - TURSKA DRAMSKA SERIJA	9:45	2,6%	23,0%	103.622
HTV1	SPORT - EMISIJA POSLIJE DNEVNIKA 3	23:07	2,6%	9,9%	101.098
Doma TV	TESKI ZLOCINI - AMERICKA KRIMINALISTICKA SERIJA	23:33	2,5%	16,0%	98.622
HTV2	NAJPOZELJNIJI DONOR - NJEMACKA ROMANTICNA KOMEDIJA	13:34	2,5%	14,5%	98.377
RTL	ZIVOT NA VAGI: LATE NIGHT	23:15	2,5%	10,8%	98.259
HTV1	VRIJEME SUTRA HTV	17:14	2,5%	9,8%	96.371
HTV2	PUTOVANJA U DALEKE KRAJEVE - DOKUMENTARNA SERIJA	15:09	2,4%	12,9%	95.300
HTV3	VELO MISTO - DRAMSKA SERIJA	20:05	2,4%	5,6%	95.188
HTV1	PREZIVLJAVANJE: PRICA O GLOBALNOM ZDRAVLJU - DOKUMENTARNA SERIJA	21:08	2,4%	5,3%	94.519
HTV1	VRIJEME SUTRA HTV	23:13	2,4%	9,4%	93.502
HTV1	EKO ZONA - EMISIJA O EKOLOGIJI	11:09	2,3%	19,7%	88.774
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	16:42	2,2%	9,4%	85.303
HTV1	VELECASNI BROWN - BRITANSKA SERIJA	15:54	2,2%	10,5%	85.010
NovaTV	PONOVNO 17 - AMERICKA ROMANTICNA KOMEDIJA	23:47	2,1%	19,6%	83.148
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:58	2,1%	5,0%	82.918
HTV1	HAK: PROMET INFO	17:15	2,1%	8,2%	81.077
HTV1	OTVORENO - POLITICKI TALK SHOW	21:59	2,1%	5,1%	80.910
HTV1	SAT PRIJE DNEVNIKA 3	22:51	2,0%	6,0%	79.593
NovaTV	RAT RUZA - TURSKA DRAMSKA SERIJA	10:54	2,0%	17,1%	79.544
HTV2	IZRADI SAM	13:24	1,9%	12,4%	74.707
HTV1	KOD NAS DOMA - MOZAICNA EMISIJA	17:19	1,9%	6,9%	73.967
RTL 2	TEORIJA VELIKOG PRASKA - AMERICKA HUMORISTICNA SERIJA	21:33	1,9%	4,2%	72.704
RTL	POGRESAN COVJEK - HRVATSKA DRAMSKA SERIJA	13:26	1,8%	10,9%	70.609
HTV1	DOBAR DAN, HRVATSKA	15:00	1,8%	9,6%	70.438
HTV2	ISTINA ILI MIT	13:20	1,8%	11,5%	70.418
RTL 2	MONK - AMERICKA KRIMINALISTICKA SERIJA	20:37	1,8%	4,0%	69.406
HTV1	POGLED PREKO GRANICE - HRVATI U BIH	14:30	1,8%	9,7%	69.294

Doma TV	NCIS: LOS ANGELES - AMERICKA KRIMINALISTICKA SERIJA	19:15	1,8%	4,4%	69.220
NovaTV	IN MAGAZIN	11:51	1,8%	11,2%	69.093
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	19:51	1,8%	4,1%	68.702
RTL	SHOPPING KRALJICA - LIFESTYLE EMISIJA	15:33	1,8%	8,7%	68.602
HTV2	ODJEVENA DA UBIJE - AMERICKI TRILER	23:44	1,7%	14,9%	68.127
RTL Kockica	A JE TO - ANIMIRANI FILM	19:35	1,6%	4,1%	64.472
RTL 2	DR. HOUSE - AMERICKA DRAMSKA SERIJA	18:55	1,6%	4,3%	63.970
RTL	HORVATOVI - HRVATSKA OBITELJSKA DRAMSKA SERIJA	14:29	1,6%	8,9%	63.890
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	16:50	1,6%	6,3%	62.297
HTV4	BEZ KOMENTARA	13:40	1,6%	9,9%	62.183
RTL 2	KRV NIJE VODA - HRVATSKA DOKUMENTARNA DRAMA	11:55	1,6%	9,9%	61.388
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	13:01	1,6%	9,9%	61.090
HTV1	POTROSACKI KOD - INFORMATIVNA EMISIJA	14:03	1,6%	8,9%	60.784
RTL 2	K.T.2: PRAVDA NA ZADATKU - DOKUMENTARNO KRIMINALISTICKA SERIJA	12:37	1,5%	9,8%	59.303
HTV1	DR. OZ - TALK SHOW	13:19	1,5%	9,4%	58.727
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	15:17	1,5%	7,7%	57.738
HTV1	VIJESTI IZ KULTURE	23:15	1,5%	6,2%	57.621
HTV1	TV KALENDAR - DOKUMENTARNA EMISIJA	6:34	1,5%	31,9%	57.375
HTV1	POLA URE KULTURE - KULTURNO OBRAZOVNA EMISIJA	21:32	1,4%	3,2%	56.726
Doma TV	ZABORAVLJENI SLUCAJ - AMERICKA KRIMINALISTICKA SERIJA	14:26	1,4%	7,8%	56.267
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:22	1,4%	3,6%	55.054
HTV4	STUDIO 4 - STUDIO	13:41	1,4%	8,4%	53.723
HTV1	CERN: U POTRAZI ZA BOZJOM CESTICOM - DOKUMENTARI FILM	23:25	1,4%	6,9%	53.244
RTL 2	SUDNICA - SHOW	10:55	1,3%	11,0%	51.819
Doma TV	MENTALIST - AMERICKA KRIMINALISTICKO DRAMSKA SERIJA	16:03	1,3%	6,1%	51.282
Doma TV	DRAGULJI NA KOTACIMA - AMERICKA REALITY SERIJA	18:52	1,3%	3,6%	51.068
RTL 2	ZALAGAONICA - DOKUMENTARNA SERIJA	17:38	1,3%	4,7%	51.005
RTL 2	DVA I POL MUSKARCA - AMERICKA HUMORISTICNA SERIJA	22:41	1,3%	4,1%	49.625
RTL	SMRT U RAJU - BRITANSKA KRIMINALISTICKA SERIJA	12:19	1,3%	8,0%	49.129
HTV2	ZAVOLITE SVOJ VRT UZ ALANA TICHMARSHA - DOKUMENTARNA SERIJA	12:30	1,3%	8,0%	48.913

HTV4	BEZ KOMENTARA	13:56	1,2%	7,6%	48.682
HTV4	STUDIO 4 - STUDIO	15:07	1,2%	6,7%	48.452
RTL 2	CSI: MIAMI - AMERICKA KRIMINALISTICKA SERIJA	14:21	1,2%	6,7%	47.647
HTV3	MALA KUCA U PRERIJI - AMERICKA DRAMSKA SERIJA	18:05	1,2%	3,7%	47.546
RTL 2	VECERA ZA 5 - LIFESTYLE EMISIJA	10:28	1,2%	10,0%	47.221
HTV3	UBOJSTVO, NAPISALA JE - AMERICKA KRIMINALISTICKA SERIJA	17:20	1,2%	4,3%	46.328
HTV4	VIJESTI HRT4	15:00	1,2%	6,3%	46.036
Doma TV	CASTLE - AMERICKA KRIMINALISTICKA SERIJA	0:27	1,2%	12,0%	45.801
HTV4	STUDIO 4 - STUDIO	15:24	1,2%	6,2%	45.153
HTV4	VRIJEME SVIJET DANAS	14:58	1,2%	6,1%	45.078
HTV4	VRIJEME SVIJET DANAS	13:58	1,2%	7,1%	44.976
HTV4	BEZ KOMENTARA	15:22	1,1%	6,2%	44.733
RTL 2	MODERNA OBITELJ - AMERICKA HUMORISTICNA SERIJA	23:11	1,1%	4,9%	44.649
HTV4	STUDIO 4 - STUDIO	13:32	1,1%	7,2%	44.102
HTV4	VIJESTI HRT4	13:59	1,1%	6,8%	43.880
HTV2	BITANGE I PRINCEZE - HRVATSKA HUMORISTICNA SERIJA	1:25	1,1%	15,5%	43.849
RTL Kockica	LOONEY TUNES - CRTANA SERIJA	19:13	1,1%	2,9%	43.768
HTV4	POSLOVNE VIJESTI	15:56	1,1%	5,6%	43.116
RTL Kockica	SOY LUNA - ARGETINSKA SERIJA ZA MLADE	18:08	1,1%	3,3%	42.560
HTV4	VRIJEME DANAS RH	15:55	1,1%	5,4%	42.209
Doma TV	U DIVLJINI SA BEAROM GRYLLSOM - REALITY SERIJA	17:36	1,1%	3,6%	42.076
HTV4	STUDIO 4 - STUDIO	14:01	1,1%	6,2%	42.009
NovaTV	COKOLADNI GRAD - AMERICKA DRAMA	1:47	1,1%	17,1%	41.803
HTV4	A SADA VLADA	15:29	1,1%	5,5%	41.262
HTV4	POSLOVNE VIJESTI	14:53	1,0%	5,6%	40.892
RTL Kockica	DOKTORICA PLISKO - ANIMIRANA SERIJA	10:35	1,0%	8,5%	40.614
RTL 2	ZASTITA GRANICA: AUSTRALIJA - DOKUMENTARNA SERIJA	17:57	1,0%	3,3%	40.439
RTL 2	ZATOCENI U INOZEMSTVU - DOKUMENTARNA EMISIJA	16:04	1,0%	4,7%	40.405
HTV4	BEZ KOMENTARA	14:56	1,0%	5,5%	40.138
RTL Kockica	DOKTORICA PLISKO - ANIMIRANA SERIJA	17:41	1,0%	3,6%	39.882
HTV4	VIJESTI HRT4	14:31	1,0%	5,7%	39.704
Doma TV	MENTALIST - AMERICKA KRIMINALISTICKO DRAMSKA SERIJA	15:16	1,0%	5,3%	39.456
HTV4	VIJESTI HRT4	15:24	1,0%	5,4%	39.386
HTV4	REGIONALNI DNEVNIK	16:00	1,0%	4,8%	38.925

NovaTV	ZAPOVJEDNI LANAC - AMERICKI AKCIJSKI FILM	2:00	1,0%	23,1%	38.908
RTL 2	CURE BEZ LOVE - AMERICKA HUMORISTICNA SERIJA	0:05	1,0%	7,6%	38.837
RTL 2	ZLOCINACKI UMOVI - AMERICKO KANADSKA KRIMINALISTICKA SERIJA	13:25	1,0%	6,0%	38.665
RTL Kockica	JAN I PIRATI IZ NIGDJEZEMSKE - ANIMIRANA SERIJA	17:15	1,0%	3,7%	37.563
RTL Kockica	MALI IZVIDACI - ZABAVNO EDUKATIVNA EMISIJA	9:29	1,0%	9,1%	37.255
HTV2	NAJPOZELJNIJI DONOR - NJEMACKA ROMANTICNA KOMEDIJA	1:57	1,0%	16,4%	37.160

Appendix 3.

Publications Resulting from this Thesis

Campbell, I., & Rudan, I. (2020). Helping global health topics go viral online. *Journal Of Global Health*, *8*(1). doi: 10.7189/jogh.10-010101

Campbell, I., & Rudan, I. (2020). Effective approaches to public engagement with global health topics. *Journal Of Global Health*, *10*(1). doi: 10.7189/jogh.10.010901

Campbell, I., & Rudan, I. (2020). Analysis of public engagement with ten major global health topics on a social network profile and a newspaper website. *Journal Of Global Health*, *10*(1). doi: 10.7189/jogh.10.010902

Campbell, I., & Rudan, I. (2020). A systematic analysis of online public engagement with 10 videos on major global health topics involving 229 459 global online viewers. *Journal Of Global Health*, *10*(1). doi: 10.7189/jogh.10.010903